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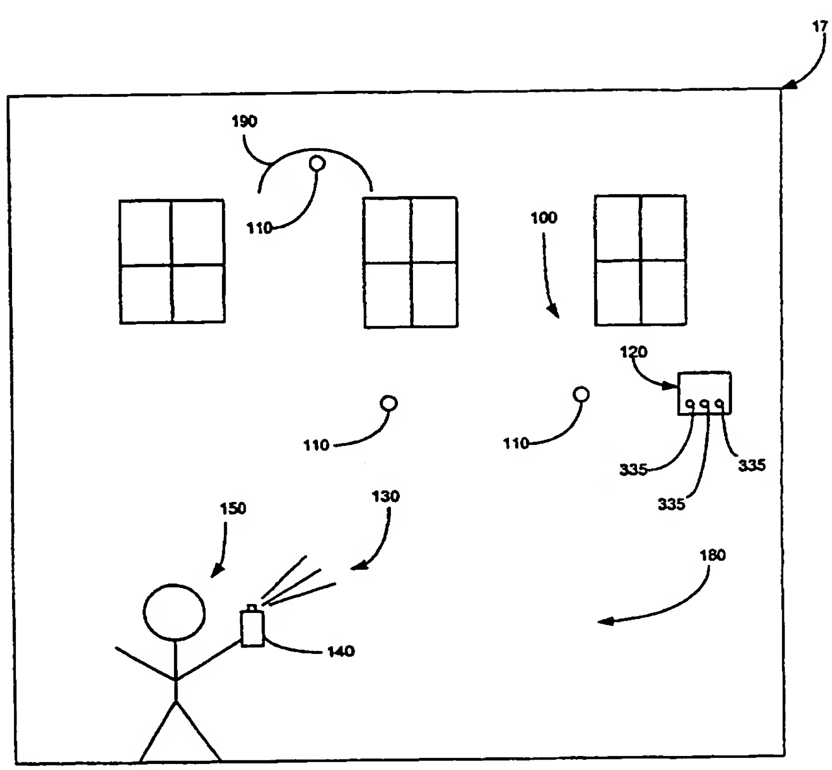
(54) Title: GRAFFITI DETECTION SYSTEM AND METHOD OF USING THE SAME



(57) Abstract: The present invention involves a system and method for detecting a graffiti-making act (130) such as the spray of a spray paint can (140), the writing with a felt-marker pen on a surface (180), and the scratching with an abrasive instrument on a surface (180). The system (100) includes one or more sensors (110) adapted to sense the graffiti-making act (130) and transmit a signal (360) representative of the graffiti-making act (130), and a base unit (120) including electronics adapted to process the signal and determined whether the signal represents a graffiti-making act (130), and a communication device (340) coupled to the electronics (210) and adapted to communicate to one or more entities (150) that a graffiti-making act (130) has been detected. The method includes sonically detecting (335) the graffiti-making act (130), and initiating an alarm (280) indicating that the graffiti-making act took place.

WO 00/75899 A1

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GRAFFITI DETECTION SYSTEM AND METHOD OF USING THE SAME

Related Applications:

This application claims priority to the following U.S. non-Provisional Application No. (Not Yet Assigned) entitled "Graffiti Detection System And Method Of Using The Same," filed June 6, 2000; and Provisional Applications: U.S. Application No. 60/137,962 entitled "Graffiti Detection System," filed June 7, 1999; U.S. Application No. 60/180,771 entitled "Olfactory Detection of Graffiti," filed February 7, 2000; and U.S. Application No. (Not Yet Assigned) entitled "Acoustical Detection of Firearm," filed March 27, 2000.

BACKGROUND OF THE INVENTION

Field of the Invention:

The present invention relates, in general, to sonic detection systems and methods, and, in particular, to graffiti detection systems and methods.

Related Art:

The following description of the background of the invention is intended to aid in the understanding of the invention, but is not admitted to describe or constitute prior art to the invention.

Every day, countless acts of graffiti are being committed to public and private property throughout the world. The property damage resulting from graffiti is estimated to be in the billions of dollars annually. Further, graffiti tends to be a recurring problem. For example, if a structure surface such as a wall is tagged with graffiti, to eliminate the graffiti, the property owner may have the graffiti removed by, for example, power washing the surface, or, more likely, will paint over the graffiti with a paint that is the same or similar to that on the rest of the surface. However, removing graffiti is frequently a temporary cure because the removed graffiti creates, in effect, a new canvas for the tagger, and invitation for another round of graffiti.

Catching the tagger is difficult because the graffiti-making act usually occurs late at night, at no-light or low-light locations, and/or at remote locations. Thus, there is often no witnesses of a graffiti-making act, allowing the tagger to get away without consequence. Even if witnesses exist, they may be too intimidated to report the tagger for fear of retaliation. If a witnesses exists, by the time the witness reports the tagger, the tagger may be long gone when the police arrive. As a result, most graffiti-related crimes go unsolved and unpunished.

SUMMARY OF THE INVENTION

Thus, an aspect of the present invention involves the recognition that a need exists for a graffiti detection system and method that is capable of detecting and reporting a graffiti-making act as it occurs. Such a system and method may give the police or property owner the head start they need to catch a tagger in the act, or if the police do not arrive in time to catch a tagger in the act, give the police the probable cause they need to detain and question any suspicious characters in the vicinity of the reported crime.

An additional aspect of the invention involves a method of detecting a graffiti-making act. The method includes sonically detecting the graffiti-making act, and initiating an alarm indicating that the graffiti-making act took place.

Implementations of the aspect of the invention described immediately above may include one or more of the following. Sonically detecting the graffiti-making act includes sonically detecting the spraying noise of a spray can. Sonically detecting the graffiti-making act includes sonically detecting the sound made by writing with a felt-marker pen on a surface. Sonically detecting the graffiti-making act includes sonically detecting a the sound made by scratching an abrasive instrument on a surface. The abrasive instrument is a member from the group consisting of a stone, a gem, a screwdriver, and a glass cutter. Sonically detecting the graffiti-making act includes sonically detecting the graffiti-making act with a sensor selected from the group consisting of a piezoelectric sensor, a dynamic sensor, an electret sensor, a carbon

sensor, a bolometer sensor, an optical reflection sensor, a capacitive sensor, an inductive sound sensor, and an ultrasonic sensor. Sonically detecting the graffiti-making act includes sensing the sound spectrum pattern of the graffiti-making act. Sonically detecting the graffiti-making act further includes sonically focusing sound produced from the graffiti-making act. Sonically focusing sound produced from the graffiti-making act includes sonically focusing the sound with a member selected from the group consisting of phase arrays, reflectors, and lenses. Sonically focusing sound produced from the graffiti-making act includes de-selecting other similar sounds that may effect a false alarm. De-selecting includes baffling sound. Sonically detecting includes filtering sound spectral characteristics of sound from the graffiti-making act. Sonically detecting includes filtering using a technique from the group consisting of duration and time coding of the sound, digital code quantitization, digitized algorithm analysis, and Fourier Transform analysis. The alarm is a member from the group consisting of a bell, a light, a horn, a speaker, a marking means, a camera to record the activity, a camera to monitor the activity, a photo process, a phone device, a wireless communication device, a cage, a trap, and a disabling means. The method further includes confirming that a graffiti-making act took place with one or more additional sensors. The one or more sensors are a member from the group consisting of a motion detector and a heat detector.

Another aspect of the invention involves a method of detecting a graffiti-making act of spraying with a spray paint can. The method includes sonically detecting a spraying noise made from the spray paint can using one or more sonic sensors, and communicating that a graffiti-making act has been detected to one or more entities.

Another aspect of the invention involves a method of detecting a graffiti-making act of spraying with a spray paint can. The method includes detecting a graffiti-making act using one or more sensors, and communicating that a graffiti-making act has been detected to one or more entities.

Implementations of the aspect of the invention described immediately above may include one or more of the following. Detecting a graffiti-making act includes sensing an odor spectrum pattern of the graffiti-making act with an olfactory sensor,

and using electronic spectral analysis to determine that a graffiti-making act occurred. Detecting a graffiti-making act includes sonically sensing a sound spectrum pattern of the graffiti-making act with a sonic sensor, and using electronic spectral analysis to determine that a graffiti-making act occurred. The graffiti-making act includes spraying with a spray paint can, and sonically sensing includes sonically sensing a spraying noise of the spray paint can. The graffiti-making act includes spraying with a spray paint can, and sonically sensing includes sonically sensing a rattling noised caused by shaking the spray paint can to mix paint inside the spray paint can. The graffiti-making act includes writing with a felt-marker pen on a surface, and sonically sensing includes sonically sensing a sound made by writing with a felt-marker pen on a surface. The graffiti-making act includes scratching with an abrasive instrument on a surface, and sonically sensing includes sonically sensing the sound made by scratching with an abrasive instrument on a surface. The method further includes confirming that a graffiti-making act took place with at least one motion detector to detect movement of a perpetrator of the graffiti-making act. The method further includes confirming that a graffiti-making act took place with at least one heat detector to detect body heat of a perpetrator of the graffiti-making act. The method further includes confirming that a graffiti-making act took place with at least one sonic detector to detect a sound of the graffiti-making act. The method further includes confirming that a graffiti-making act took place with at least one olfactory detector to detect an odor of the graffiti-making act. Detecting a graffiti-making act includes amplifying a signal from the at least one sensor to a distinguishable level, combining the signal with a predetermined signature signal, reducing signal noise, and determining whether the resulting signal includes a spectrum pattern matching a predetermined spectrum pattern of one or more graffiti-making acts. Communicating to one or more entities includes communicating to a police dispatcher. Communicating to one or more entities includes communicating to one or more police officers on patrol in a general area of the graffiti-making act. Communicating to one or more entities includes communicating to an owner of a property where the graffiti-making act took place. Communicating to one or more entities includes communicating to a security system center. Communicating to one or

more entities includes dialing one or more predetermined phone numbers. Communicating to one or more entities includes communicating one or more of the following: a graffiti-marking act has been detected, the location of the graffiti-marking act, the type of graffiti-marking act, the time the graffiti marking act took place. Detecting a graffiti-making act includes detecting a graffiti-making act using one or more sensors and a base unit powered by a battery, and the method further including communicating to one or more entities that the battery is low and needs to be replaced. The one or more sensors communicate wirelessly with a base unit, and detecting a graffiti-making act includes transmitting a signal representative of the graffiti-making act to the base unit for processing of the signal. Detecting the graffiti-making act includes detecting one or more different graffiti-making acts with one or more different types of sensors. Detecting the graffiti-making act includes detecting multiple graffiti-making acts with a single sensor.

An additional aspect of the invention includes a graffiti detection system for detecting a graffiti-making act. The system includes one or more sensors adapted to sense the graffiti-making act and transmit a signal representative of the graffiti-making act, and a base unit including electronics adapted to process the signal and determined whether the signal represents a graffiti-making act, and a communication device coupled to the electronics and adapted to communicate to one or more entities that a graffiti-making act has been detected.

Implementations of the aspect of the invention described immediately above may include one or more of the following. The one or more sensors include one or more olfactory sensors adapted to sense an odor spectrum pattern of the graffiti-making act and transmit a signal representative of the odor spectrum pattern of the graffiti-making act, and the electronics adapted to process the signal to determine if the odor spectrum pattern represents a graffiti-making act. The one or more sensors include one or more sonic sensors adapted to sense a sound spectrum pattern of the graffiti-making act and transmit a signal representative of the sound spectrum pattern of the graffiti-making act, and the electronics adapted to process the signal to determine if the sound spectrum pattern represents a graffiti-making act. The one or more sonic sensors are adapted to sense a

spraying noise of a spray can. The one or more sonic sensors are adapted to sense a rattling noised caused by shaking the spray paint can to mix paint inside the spray paint can. The one or more sonic sensors are adapted to sense the sound made by writing with a felt-marker pen on a surface. The one or more sonic sensors are adapted to sense a sound made by scratching with an abrasive instrument on a surface. The system further includes a motion detecting sensor adapted to detect movement of a perpetrator of the graffiti-making act for confirming that a graffiti-making act took place. The system further includes a heat detecting sensor adapted to detect body heat of a perpetrator of the graffiti-making act for confirming that a graffiti-making act took place. The system further includes an olfactory detector adapted to detect an odor of the graffiti-making act for confirming that a graffiti-making act took place. The system further includes a sonic detector adapted to detect a sound of the graffiti-making act for confirming that a graffiti-making act took place. The electronics include a pre-amplifier adapted to amplify the signal from the at least one sensor to a distinguishable level, a mixer adapted to combine the signal with a predetermined signature signal, a low-pass filter and a precision rectifier adapted to reduce signal noise, and a time domain characterization mechanism adapted to determine whether the resulting signal represents a graffiti-making act. The time domain characterization mechanism includes a charge pump. The time domain characterization mechanism includes a quantitative characterization device such as a microprocessor to determine whether the resulting signal includes a spectrum pattern matching a predetermined spectrum pattern of one or more graffiti-making acts for a predetermined period of time. The communication device is adapted to communicate with a police dispatcher. The communication device is adapted to communicate with one or more police officers on patrol in a general area of the graffiti-making act. The communication device is adapted to communicate with an owner of the property where the graffiti-making act took place. The communication device is adapted to communicate with a security system center. The communication device is adapted to dial one or more predetermined phone numbers. The base unit is adapted to be powered by a battery, and the communication device is adapted to communicate to one or more entities that the battery is low and needs to be replaced. The one or more sensors are adapted to communicate

wirelessly with the base unit. The one or more sensors are adapted to communicate with the base unit through wired means. The one or more sensors are integral with the base unit. The one or more sensors include one or more different types of sensors adapted to sense one or more different types of graffiti-making acts. The one or more sensors include a single sensor adapted to sense more than one different types of graffiti-making acts. The one or more sensors include one or more of the following types of sensors: a piezoelectric sensor, a dynamic sensor, an electret sensor, a carbon sensor, a bolometer sensor, an optical reflection sensor, a capacitive sensor, an inductive sound sensor, and an ultrasonic sensor. The one or more sensors are adapted to sense the sound of a graffiti-making act up to a distance of 400 feet. The one or more sensors are adapted to send either a 900 megahertz or a spread spectrum signal. The electronics are adapted to filter sound using a technique from the group consisting of duration and time coding of the sound, digital code quantitization, digitized algorithm analysis, and Fourier Transform analysis. The base unit includes an alarm selected from the group consisting of a bell, a light, a horn, a whistle, a speaker, a marking means, a camera to record the activity, a camera to monitor the activity, sprinkler, a cage, a trap, and a disabling means.

A still further aspect of the invention involves a graffiti detection system for detecting a graffiti-making act. The system includes means for sensing the graffiti-making act and transmitting a signal representative of the graffiti-making act, and a base unit including means for determining whether the signal represents a graffiti-making act, and means for communicating to one or more entities that a graffiti-making act has been detected.

An additional aspect of the present invention involves a method of detecting a firearm shot. The method includes sonically detecting the firearm shot using one or more sonic sensors, and initiating an alarm indicating that the firearm shot took place.

Implementations of the aspect of the invention described immediately above may include one or more of the following. Sonically detecting the firearm shot includes sonically detecting a shot of one or more different firearms. Sonically detecting the firearm shot includes sonically detecting the firearm shot with a sensor selected from the group consisting of a piezoelectric sensor, a dynamic sensor, an

electret sensor, a carbon sensor, a bolometer sensor, an optical reflection sensor, a capacitive sensor, an inductive sound sensor, and an ultrasonic sensor. Sonically detecting the firearm shot includes detecting a sound spectrum pattern of the firearm shot. Sonically detecting the firearm shot includes sonically detecting the firearm shot with one or more sonic sensors mounted to a fixed object. Sonically detecting the firearm shot includes sonically detecting the firearm shot with one or more sonic sensors mounted to a movable object. The method further includes determining the location of the firearm shot using an automatic location identification device and communicating the location of the firearm shot to the police. Sonically detecting includes filtering sound spectral characteristics of sound from the firearm shot. Sonically detecting includes filtering using a technique from the group consisting of duration and time coding of the sound, digital code quantitization, digitized algorithm analysis, and Fourier Transform analysis. The alarm is a member from the group consisting of a bell, a light, a horn, a speaker, a marking means, a camera to record the activity, a camera to monitor the activity, a photo process, a phone device, a wireless communication device, a cage, a trap, an automatic locking door, and a disabling means. Initiating an alarm includes communicating to one or more entities that a firearm shot occurred. Communicating to one or more entities includes communicating to a police dispatcher. Communicating to one or more entities includes communicating to one or more police officers in an area near where the firearm shot occurred. Communicating to one or more entities includes communicating to a security system center. Communicating to one or more entities includes dialing one or more predetermined phone numbers. The method further includes communicating one or more of the following to the one or more entities: a firearm shot has been detected, the location of the firearm shot, the type of firearm shot, and the time of the firearm shot. Detecting a firearm shot includes detecting a firearm shot using one or more sensors and a base unit powered by a battery, the method further including communicating to one or more entities that the battery is low and needs to be replaced. The one or more sensors communicate wirelessly with a base unit, and detecting a firearm shot includes transmitting a signal representative of the firearm shot to the base unit for processing of

the signal. Detecting the firearm shot includes detecting one or more different types of firearm shots with one or more different types of sonic sensors. Confirming that a firearm shot took place with one or more additional sensors. One or more additional sensors are a member from the group consisting of a motion sensor and a heat sensor. Detecting a firearm shot includes determining whether a sound spectrum pattern of a firearm shot matches a sound spectrum pattern of one or more a predetermined stored fire arm shot sound spectrum patterns. The method further includes amplifying a signal from the at least one sonic sensor to a distinguishable level, combining the signal with a predetermined signature signal, reducing signal noise, and determining whether the resulting signal represents one or more predetermined types of firearm shots for a predetermined period of time.

Another aspect of the invention includes a firearm shot detection system for detecting a firearm shot. The firearm shot detection system includes one or more sonic sensors adapted to sonically sense the firearm shot and transmit a signal representative of the sound of the firearm shot, and a base unit including electronics adapted to receive the signal and process the signal to determine if the signal represents one or more predetermined firearm shots, and a communication device coupled to the electronics and adapted communicate to one or more entities that a firearm shot has been detected.

Implementations of the aspect of the invention described immediately above may include one or more of the following. The system further includes a motion detecting sensor adapted to sense movement of a shooter of the firearm shot for confirming that a firearm shot took place. The system further includes a heat detecting sensor adapted to sense body heat of a shooter of the firearm shot for confirming that a firearm shot took place. The electronics include a pre-amplifier adapted to amplify the signal from the at least one sensor to a distinguishable level, a mixer adapted to combine the signal with a predetermined signature signal, a low-pass filter and a precision rectifier adapted to reduce signal noise, and a time domain characterization mechanism adapted to determine whether the resulting signal represents one or more different types of firearm shots for a predetermined period of time. The time domain characterization mechanism includes a charge pump. The time domain characterization

mechanism includes a quantitative characterization device, quantitative characterization device including a microprocessor to determine whether the resulting signal includes a spectrum pattern matching a predetermined spectrum pattern of one or more firearm shots for a predetermined period of time. The communication device is adapted to communicate with a police dispatcher. The communication device is adapted to communicate with one or more police officers near an area of the firearm fire shot. The communication device is adapted to communicate with a security system center. The communication device is adapted to dial one or more predetermined phone numbers. The base unit is adapted to be powered by a battery, and the communication device is adapted to communicate to one or more entities that the battery is low and needs to be replaced. The one or more sensors are adapted to communicate wirelessly with the base unit. The one or more sensors are adapted to communicate with the base unit through wired means. The one or more sensors are integral with the base unit. The one or more sensors include one or more different types of sensors adapted to sense one or more different types of firearm shots. The one or more sensors are one or more sonic sensors adapted to sense a broad range of sound frequencies. The one or more sensors are one or more sonic sensors adapted to sense sound frequencies or a sound frequency that is the same as or similar to that of the sound of one or more specific of firearm shots. The one or more sensors include a single sensor adapted to sense more than one different type of firearm shot. The one or more sensors include one or more different types of sensors. The one or more sensors include one or more of the following types of sensors: a piezoelectric sensor, a dynamic sensor, an electret sensor, a carbon sensor, a bolometer sensor, an optical reflection sensor, a capacitive sensor, an inductive sound sensor, and an ultrasonic sensor. The electronics are adapted to filter sound using a technique from the group consisting of duration and time coding of the sound, digital code quantitization, digitized algorithm analysis, and Fourier Transform analysis. The base unit includes an alarm selected from the group consisting of a bell, a light, a horn, a speaker, a marking means, a camera to record the activity, a camera to monitor the activity, a photo process, a cage, a trap, an automatic locking door and a disabling means. The system is adapted to be mounted to a movable object, the base unit

includes an automatic location identification device for identifying the location of the system, and the communication device is adapted to communicate the location of the firearm shot to one or more entities. The communication device is adapted to communicate one or more of the following to one or more entities: a firearm shot has been detected, the location of the firearm shot, the time of the firearm shot, and the type of the firearm shot.

A further aspect of the invention involves a method of detecting a leak of a vehicle tire. The method includes detecting a leak of a vehicle tire using one or more sonic sensors, and initiating an alarm indicating that the tire leak took place.

Implementations of the aspect of the invention described immediately above may include one or more of the following. Detecting the leak of a vehicle tire includes sonically detecting one or more different types of vehicle tire leaks. Detecting the leak of a vehicle tire includes sonically detecting the leak of a vehicle tire with a sensor selected from the group consisting of a piezoelectric sensor, a dynamic sensor, an electret sensor, a carbon sensor, a bolometer sensor, an optical reflection sensor, a capacitive sensor, an inductive sound sensor, and an ultrasonic sensor. Detecting the leak of a vehicle tire includes detecting a sound spectrum pattern of the leak of a vehicle tire. Detecting the leak of a vehicle tire includes detecting the leak of a vehicle tire with one or more sonic sensors mounted to a vehicle. Detecting the leak of a vehicle tire includes detecting the leak of a truck tire and/or trailer tire. Detecting a leak of a vehicle tire includes filtering a signal from the one or more sensors using a technique from the group consisting of duration and time coding, digital code quantitization, digitized algorithm analysis, and Fourier Transform analysis. Initiating an alarm includes communicating to a driver of the vehicle that a vehicle tire leak has taken place. Initiating an alarm includes communicating to a vehicle dispatcher that a vehicle tire leak has taken place. Initiating an alarm includes communicating to one or more entities one or more of the following: a vehicle tire leak has been detected, the vehicle that the tire leak has been detected from, the location of the vehicle tire that the tire leak has been detected from, the type of vehicle tire leak, and the time of the vehicle tire leak. Detecting a vehicle tire leak includes detecting a vehicle tire leak using one or

more sensors and a base unit powered by a battery, the method further including communicating to one or more entities that the battery is low and needs to be replaced. The one or more sensors communicate wirelessly with a base unit, and detecting a leak of a vehicle tire includes transmitting a signal representative of the leak of a vehicle tire to the base unit for processing of the signal. Detecting a tire leak includes determining whether a tire leak occurred using electronic spectral analysis. Detecting a tire leak includes amplifying a signal from the at least one sonic sensor to a distinguishable level, combining the signal with a predetermined signature signal, reducing signal noise, and determining whether the resulting signal represents one or more predetermined types of vehicle tire leaks for a predetermined time period.

A still further aspect of the invention involves a vehicle tire leak detection system for detecting a leak of a vehicle tire. The vehicle tire leak detection system includes one or more sonic sensors adapted to sense the leak of a vehicle tire and transmit a signal representative of the sound of the leak of the vehicle tire, and a base unit including electronics adapted to receive the signal and process the signal to determine if the signal represents one or more predetermined types of vehicle leaks, and a communication device coupled to the electronics and adapted to communicate to one or more entities that a vehicle tire leak has been detected.

Implementations of the aspect of the invention described immediately above may include one or more of the following. The electronics include a pre-amplifier adapted to amplify the signal from the at least one sensor to a distinguishable level, a mixer adapted to combine the signal with a predetermined signature signal, a low-pass filter and a precision rectifier adapted to reduce signal noise, and a time domain characterization mechanism adapted to determine whether the resulting signal represents one or more different types of vehicle tire leaks for a predetermined period of time. The time domain characterization mechanism includes a charge pump. The time domain characterization mechanism includes a quantitative characterization device, the quantitative characterization device includes a microprocessor adapted to determine whether the resulting signal represents one or more different predetermined types of vehicle tire leaks for a predetermined period of time. The communication

device is adapted to communicate with a driver of a vehicle that the vehicle tire leak is from. The communication device is adapted to communicate with a vehicle dispatcher that a vehicle tire leak took place. The base unit is adapted to be powered by a battery, and the communication device is adapted to communicate to one or more entities that the battery is low and needs to be replaced. The one or more sensors are adapted to communicate wirelessly with the base unit. The one or more sensors are adapted to communicate with the base unit through wired means. The one or more sensors include one or more different types of sensors adapted to sense different types of vehicle tire leaks. The one or more sensors include one or more of the following types of sensors: a piezoelectric sensor, a dynamic sensor, an electret sensor, a carbon sensor, a bolometer sensor, an optical reflection sensor, a capacitive sensor, an inductive sound sensor, and an ultrasonic sensor. The electronics are adapted to filter the signal using a technique from the group consisting of duration and time coding of the sound, digital code quantitization, digitized algorithm analysis, and Fourier Transform analysis. The one or more sensors are integral with the base unit. The base unit includes an automatic location identification device adapted to determine the location of the vehicle. The communication device is adapted to communicate to one or more entities one or more of the following: a vehicle tire leak has been detected, the vehicle that the vehicle tire leak is from, the location of the vehicle that the vehicle tire leak is from, the type of vehicle tire leak, and the time of the vehicle tire leak.

A yet further aspect of the invention involves a method of detecting an act. The method includes detecting a characteristic sound made by the act using one or more sonic sensors, and initiating an alarm indicating that the act place.

Implementations of the aspect of the invention described immediately above may include one or more of the following. The act is the crying of a baby. The act is equipment use. Detecting equipment use includes sonically detecting one or more different types of equipment use. Detecting equipment use includes sonically detecting equipment use with a sensor selected from the group consisting of a piezoelectric sensor, a dynamic sensor, an electret sensor, a carbon sensor, a bolometer sensor, an optical reflection sensor, a capacitive sensor, an inductive sound sensor, and an ultrasonic sensor.

Detecting equipment use includes detecting a sound spectrum pattern of a characteristic sound made by use of equipment. Detecting equipment use includes detecting the use of one or more of the following types of equipment: a computer, a cash register, a copy machine, and a fax machine. Detecting equipment use includes filtering a signal from the one or more sensors using a technique from the group consisting of duration and time coding, digital code quantitization, digitized algorithm analysis, and Fourier Transform analysis. Initiating an alarm includes automatically shutting down the equipment. Initiating an alarm includes communicating to one or more entities that equipment use has taken place. Initiating an alarm includes communicating to one or more entities one or more of the following: equipment use has been detected, the type of equipment that the use has been detected from, the location of the equipment that the equipment use has been detected from, and the time of the equipment use. Detecting equipment use includes detecting equipment use using one or more sensors and a base unit powered by a battery, the method further including communicating to one or more entities that the battery is low and needs to be replaced. The one or more sensors communicate wirelessly with a base unit, and detecting equipment use includes transmitting a signal representative of the sound made by the equipment use to the base unit for processing of the signal. Detecting equipment use includes determining whether equipment use occurred using electronic spectral analysis. Detecting equipment use includes amplifying a signal from the at least one sonic sensor to a distinguishable level, combining the signal with a predetermined signature signal, reducing signal noise, and determining whether the resulting signal represents one or more predetermined types of equipment use for a predetermined time period.

An additional aspect of the invention involves an act detection system for detecting an act. The act detection system includes one or more sonic sensors adapted to sense a characteristic sound made by the act and transmit a signal representative of the characteristic sound made by the act, and a base unit including electronics adapted to receive the signal and process the signal to determine if the signal represents one or more predetermined types of acts, and a communication device coupled to the electronics and adapted to communicate to one or more entities that an act has been detected.

Implementations of the aspect of the invention described immediately above may include one or more of the following. The act is the crying of a baby. The act is equipment use. The electronics include a pre-amplifier adapted to amplify the signal from the at least one sensor to a distinguishable level, a mixer adapted to combine the signal with a predetermined signature signal, a low-pass filter and a precision rectifier adapted to reduce signal noise, and a time domain characterization mechanism adapted to determine whether the resulting signal represents one or more different types of equipment use for a predetermined period of time. The time domain characterization mechanism includes a charge pump. The time domain characterization mechanism includes a quantitative characterization device, the quantitative characterization device includes a microprocessor adapted to determine whether the resulting signal represents one or more different predetermined types of equipment use for a predetermined period of time. The one or more sensors are adapted to communicate wirelessly with the base unit. The one or more sensors are adapted to communicate with the base unit through wired means. The one or more sensors include one or more different types of sensors adapted to sense different types of equipment use. The one or more sensors include one or more of the following types of sensors: a piezoelectric sensor, a dynamic sensor, an electret sensor, a carbon sensor, a bolometer sensor, an optical reflection sensor, a capacitive sensor, an inductive sound sensor, and an ultrasonic sensor. The electronics are adapted to filter the signal using a technique from the group consisting of duration and time coding of the sound, digital code quantitization, digitized algorithm analysis, and Fourier Transform analysis. The one or more sensors are integral with the base unit. The base unit includes an automatic location identification device adapted to determine the location of the equipment use. The communication device is adapted to communicate to one or more entities one or more of the following: an equipment use has been detected, the time of the equipment use, the type of equipment use, and/or the location of the equipment use. The base unit is adapted to be powered by a battery, and the communication device is adapted to communicate to one or more entities that the battery is low and needs to be replaced.

Other and further objects, features, aspects, and advantages of the present invention will become better understood with the following detailed description of the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS:

The drawings illustrate both the design and utility of preferred embodiments of the present invention, in which:

FIG. 1 is an illustration of an embodiment of a graffiti detection system and method in an exemplary environment.

FIG. 2 is a block diagram of an embodiment of the graffiti detection system illustrated in FIG. 1.

FIG. 3A is block diagram of an embodiment of a time domain characterization mechanism.

FIG. 3B is a block diagram of an alternative embodiment of a time domain characterization mechanism.

FIG. 4A is an illustration of an embodiment of a detection system similar to that illustrated in FIGS. 1-3, but for use in detection of a firearm shot, and is shown in an exemplary environment.

FIG. 4B is an illustration of an alternative embodiment of a firearm shot detection system and method and is shown in an alternative exemplary environment.

FIG. 5 is an illustration of an embodiment of a detection system similar to that illustrated in FIGS. 1-3, but for use in detection of a vehicle tire leak, and is shown in an exemplary environment..

FIG. 6 is an illustration of an embodiment of a detection system similar to that illustrated in FIGS. 1-3, but for use in detecting the use of equipment such as a computer, and is shown in an exemplary environment.

DETAILED DESCRIPTION OF THE INVENTION

With reference to FIG. 1, an embodiment of a graffiti detection system 100 and method of using the same will now be described. The graffiti detection system 100

detects a graffiti-making act and initiates one or more alarms to indicate that a graffiti-making act occurred. Examples of graffiti-making acts that are capable of being detected by the system 100 include, but not by way of limitation, the spraying noise that occurs with the spraying or tagging of a surface with a spray paint can, the rattling noise that occurs when shaking a spray paint can to mix the paint inside, the sound of a felt marker on a surface as the surface is being marked, and the sound of an abrasive device such as a glass cutter, diamond, razor, etc. as it scratches, defaces, or etches a surface such as glass. The graffiti detection system 100 includes one or more primary sensors 110 and a control unit or base unit 120.

Each primary sensor 110 is preferably a sonic sensor capable of picking up sound waves and converting the sound waves into electronic signals for further processing. Each sonic sensor may be capable of sensing a wide variety of sound frequencies, even sounds in the ultrasound frequency range. Examples of sensors 110 that may be used as a sonic sensor include, but not by way of limitation, a piezoelectric sensor, a dynamic sensor, an electret sensor, a carbon sensor, a bolometer sensor, an optical reflection sensor, a capacitive sensor, an inductive sound sensor, and an ultrasonic sensor used to detect and respond to specific sound spectrum patterns.

A graffiti-making act 130 such as the spraying noise from an aerosol spray paint can 140 by a perpetrator or tagger 150 has a specific sound spectrum frequency pattern or sound signature. The one or more sensors 110 may convert the sound of the spraying noise into a corresponding electronic signal.

Depending on the type of sonic sensor, each sensor 110 may be adapted to pick up a narrow frequency range or individual frequency of sound waves or a broad frequency spectrum of sound waves.

In the first instance, detection of a graffiti-making act 130 may occur, in essence, at the sensor 110. The system 100 may rely more on the inherent frequency characteristics of sensor(s) 110 for identification of a sound signature of a graffiti making act 130. For example, the sensor(s) 110 may only transmit a single frequency signal, e.g., a 900 megahertz signal, if a certain frequency or certain frequencies of sound are picked up by the sensor(s) 110. Thus, a specific sensor 110 may be used to

detect a specific graffiti-making act 130, without the requirement of much identification processing by the base unit 120. In this embodiment, if the specific sensor 110 transmits an electronic signal, the base unit 120 may be able to assume, except for some minor processing and possible confirmation, that the specific graffiti-making act 110, which the specific sensor 110 is adapted to sense, has occurred. In this embodiment, different sensors 110 may be assigned to sense different graffiti-making acts 130, one or more of which may be used in the system 100. For example, a sensor A may be used to detect the spraying noise that occurs with the spraying or tagging of a surface with a spray paint can, a sensor B may be used to detect the sound of the rattling noise that occurs when shaking a spray paint can to mix the paint inside, a sensor C may be used to detect the sound of a felt marker on a surface as the surface is being marked, and a sensor D may be used to detect the sound of an abrasive device such as a glass cutter, diamond, razor, etc. as it scratches, defaces, or etches a surface such as glass.

In the latter instance, detection of a graffiti-making act 130 may occur, in essence, at the base unit 120. The system 100 may rely more on the base unit 120 to identify a graffiti-making act 130. In this embodiment, the sensor(s) 110 may pick up a broader range of frequencies and transmit them to the base unit 120 as a spread spectrum signal for processing and identification. Thus, in order to reduce the number of sensors used to detect a number of different types of graffiti-making acts, a single sensor 110 may be used to sense all the sound frequencies or sound frequency ranges of the graffiti-making acts 130 of interest and use the base unit 120 to process and determine whether the transmitted signal(s) correspond to a graffiti-making act.

The sensor(s) 110 may be one or more of the same or different types of sensors 110. For example, the sensor(s) 110 may include multiple sonic sensors of one or more different sonic sensor types. For example, as described above, specific sensors may be adapted to pick up specific sound frequencies or ranges of sound frequencies. The different types of sensors 110 may be used to pick up different frequency ranges for the same type of graffiti-making act, e.g., different frequency ranges for different spray noises made from different types of spray paint cans, or to pick up different frequency ranges for different types of graffiti-making acts, e.g., a first sensor may be used to

detect spray painting, a second sensor may be used to detect the sound of a felt marker on a surface as the surface is being marked, etc.

Further, not only may the one or more sensors 110 be one or more different types of sonic sensors, the one or more sensors 110 may include one or more sensors other than sonic sensors in addition to or instead of one or more sonic sensors. For example, the one or more sensors 110 may include one or more olfactory sensors in addition to or instead of the one or more sonic sensors. An exemplary olfactory sensor that may be used in the system 100 is the NOSE CHIP™ made by Cyrano Sciences, Inc. of Pasadena, California. An olfactory sensor may be used in conjunction with the base unit 120 to sense the presence of one or more odors indicative of a graffiti-making act. For example, the olfactory sensor may be used to sense the odor of the propellant from a spray paint can, one or more other chemicals such as those from the paint of a spray paint can, the odor of xylene from a felt-tip marker, etc. One or more olfactory sensors may be used as one or more primary sensors 110 or primary means for detecting the occurrence of a graffiti-making act 130 or as a secondary sensor 335 or secondary means for confirming the occurrence of a graffiti-making act 130.

The one or more sensors 110 may communicate wirelessly with the base unit 120 or may be wired to the base unit 120. In a wireless embodiment, the one or more sensors 110 include a transmitter for wirelessly transmitting the signal(s) to the base unit 120 and a battery or other power supply. If one or more wireless piezoelectric sensors are used, the sensor(s) 110 may be located up to a distance of 400 ft. from the base unit 120 and still communicate therewith. If a 2.4 GHz sensor is used, the sensor(s) 110 may be located at a distance greater than 400 ft. from the base unit 120. A wireless piezoelectric sensor can also sense the noise from a graffiti making at a distance of 1000 ft or more from the graffiti-making act, especially if focusing an baffling mechanisms are used.

It is important to note, although the one or more sensors 110 are shown in FIG. 1 as being separate or remote from the base unit 120, in an alternative embodiment, the one or more sensors 110 may be integrated with the base unit 120 so that the system

100 forms a single unit. Further, one or more of the sensors 110 may be integrated with the base unit 120 and separate therefrom.

The one or more sensors 110 are preferably small, a few inches or less in size, making the sensor(s) 110 easy to conceal. The one or more sensors 100 are preferably strategically located at one or more locations in a vicinity 170 of a surface 180 prone to graffiti. The one or more sensors 110 may be mounted in direct contact with a surface such as, but not by way of limitation, a glass surface, a concrete wall, a brick wall, and the side of a building. Preferably, each sensor 110 is mounted at a location that is inconspicuous and inhibits tampering or deactivation.

The distance between the one or more sonic sensors and the graffiti-making act may be increased, allowing sensing from a more distant, inconspicuous position, if one or more sound focusing mechanisms 190 are used. Examples of sound focusing mechanisms that may effectively increase the signal-to-noise ratio of the sound detected by the one or more sonic sensors include, but not by way of limitation, a parabolic reflector, boom, shotgun directional microphone, phase array, or lens. FIG. 1 illustrates a sound focusing mechanism 190 in the form of a parabolic reflector adjacent to one of the sensors 110 in order to increase the signal-to-noise ratio of the sound detected by the sensor 110.

With reference additionally to FIGS. 2 and 3, the base unit 120 is also preferably strategically located in the vicinity 170 of the surface 180 prone to graffiti, at a location that is inconspicuous and inhibits tampering or deactivation. The base unit 120 may include a water-resistant housing 200 made of metal or plastic. The base unit 120 may include electronics 210 comprising hardware or hardware and software that processes the signal(s) from the one or more sensors 110, and initiates one or more alarms if a graffiti-making act is identified. The hardware and/or software of the base unit 120 may also determine whether a graffiti-making act 130 occurred by determining whether the signal(s) from the one or more sensors 110 correspond to a graffiti-making act. The hardware and/or software may also perform other functions described herein. Examples of hardware that may perform the functions described herein include, but not by way of limitation, an application specific integrated circuit (ASIC), a set of wired

logic circuits, and a hardwired circuit of electrical components, e.g., transistors, capacitors, and resistors. Examples of hardware and software that may perform the functions described herein include, but not by way of limitation, a programmed computer and an application specific computer.

In an embodiment of the base unit 120, the hardware and/or software may include a preamplifier 220, a mixer 230, a low pass filter 240, a precision rectifier 250, and a time domain characterization mechanism 260. The preamplifier 220, the mixer 230, the low pass filter 240, and the precision rectifier 250 may form part of a sensor interface for processing the incoming signal(s) from the one or more sensors 110, which will now be described. A signal from the one or more sensors 110 is amplified by the preamplifier 220 to a distinguishable level. The mixer 230 may combine the resulting signal with a predetermined center frequency from a local oscillator 270. If the frequency of the signal from the one or more sensors 110 closely matches the frequency of the local oscillator signal, heterodyning occurs, producing a high gain product signal. Next, the low pass filter 240 and the precision rectifier 250 combine to improve the signal to noise ratio by eliminating noise such as AC signals and passing only DC signals. The signal may then be authenticated, i.e., a determination may be made as to whether the signal represents a graffiti-making act, by the time domain characterization mechanism 260.

With reference to FIG. 3A, in an embodiment of the time domain characterization mechanism 260, the time domain characterization mechanism 260 may include a charge pump 270 for determining whether the signal represents a graffiti-making act 130. The charge pump 270 may include an electric circuit having one or more capacitors. The incoming signal charges the one or more capacitors, causing a rise in voltage over time until a signature signal of sufficient duration is authenticated, i.e., signal is transmitted to the one or more capacitors for a predetermined period of time determined by the time constant selected. Requiring that a signature signal be transmitted for a certain period of time helps to ensure that a graffiti-making act is accurately identified. After the signal is identified, a comparitor is triggered, causing an alarm 280 (FIG. 2) to be actuated. This embodiment of the time domain

characterization mechanism 260 may be desirable if the one or more sensors 110 are adapted to pick up a narrow sound frequency range or individual sound frequency similar to or the same as that of a predetermined graffiti-making act because the components of the electronics 210 described above assume that if a signal is transmitted to the electronics 210, the signal is similar to or the same as that of a graffiti-making act, i.e., the one or more sensors 110 only deliver a signal if the frequency of the signal is similar to or the same as that of a graffiti-making act. The charge pump 270 functions to set a minimum time duration condition on the sound sensed by the one or more sensors 110, inhibiting false alarms caused by transient sounds from non-graffiti-making acts of the same or similar frequency. Thus, the charge pump 270 serves to authenticate the signal as one by a graffiti-making act by the ensuring the signal is of a predetermined duration as determined by the type of capacitor used.

With reference to FIG. 3B, in an alternative embodiment, the time domain characterization mechanism 260 may include a quantization characterization mechanism 290. The quantization characterization mechanism 290 may include a microprocessor 300, which may be the same as or different from any other microprocessor used in the system 100, and memory 310. The microprocessor 300 may use a digital signal processing application 320 stored in memory 310 to convert an analog signal from the low pass filter 240 into a digitized signal, and quantitize the resulting digital signal. The resulting quantitized information may be compared to a matrix of numbers 330 stored in memory 310 or a different memory for authentication of the signal(s) from the one or more sensors 110. The memory 310 may include multiple matrices of numbers 330 representing multiple respective predetermined graffiti-making acts 130 that the quantitized information from one or more signals may be compared to for determining the occurrence of multiple graffiti-making acts 130. The quantitized information may also include the duration of the signal(s) to ensure that the signal(s) is for at least a minimum duration to ensure that a graffiti-making act is accurately identified, inhibiting false alarms. After the signal is identified, the microprocessor 300 may cause the alarm 280 (FIG. 2) to be actuated. This embodiment of the time domain characterization mechanism 260 is desirable if the one or more

sensors 110 are adapted to pick up a broad sound frequency range or different broad sound frequency ranges because the quantization characterization mechanism 290 may identify the signals from one or more different types of graffiti-making acts, allowing the graffiti detection system 100 to detect one or more different types of graffiti-making acts.

Those skilled in the art will recognize other well-known sound signature identification techniques may be used such as, but not by way of limitation, digitized algorithm analysis and Fourier Transform analysis.

The electronics 210 of the base unit 120 may include one or more of the following secondary sensors 335 or confirming means to confirm or further ensure that a graffiti-making act 130 occurred: a motion sensor to detect motion of the tagger 150, a heat sensor to sense body heat of the tagger 150, an olfactory sensor to detect an odor of a graffiti-making act, and a sonic sensor to detect a sound of a graffiti-making act.

The alarm 280 initiated or actuated after a graffiti-making act has occurred may include, but not by way of limitation, one or more of the following: an alarm to alert the tagger 150 and/or anyone in the vicinity that a graffiti-making act has been detected such as a bell, a light, a horn, a whistle, or a speaker; a marking mechanism adapted to mark the tagger 150 so that the police can easily identify the tagger 150 and have probable cause to arrest the tagger 150; a water sprinkler to wash the tagged surface 180; an infrared security video camera for recording and/or monitoring the tagger 150 committing the graffiti-making act 130, a flash camera to capture a still image of the tagger 150 committing the graffiti-making act, a disabling mechanism such as a cage, trap, e.g., two doors that automatically lock the tagger 150 in an area therebetween; and one or more communication devices 340 or interfaces. In a preferred embodiment, the alarm 280 does not alert the tagger 150 that a graffiti-making act has been detected by the system 100, but causes the communication device 340 to communicate to one or more entities or locations such as, but not by way of limitation, a police dispatcher so that a nearby police officer can be alerted as to the situation, one or more police officers on patrol in the general area of the graffiti-making act, an owner of the property where the graffiti-making act took place, and/or a security system center that a graffiti-making

act has occurred. The communication device 340 may be any well-known communication device such as, but not by way of limitation, a dialer, a modem, a network interface (such as an Ethernet card), a communications port, a PCMCIA slot and card, a short-wave radio, etc. that may communicate voice, text, and/or video information to the one or more entities or locations. For example, the communication device 340 may be a dialer that dials one or more predetermined telephone numbers, pager numbers, wireless cellular or digital telephone numbers, and/or internet phone or device numbers for communicating a prerecorded voice, text message, and/or video clip indicating that the graffiti-making act took place. The voice and/or text message may include one or more of the following: the location of the graffiti-marking act, the type of graffiti-marking act, and/or the time the graffiti marking act took place.

In a preferred embodiment, a dialer is used as the communication device 340 and is capable of both listening at the site where detection has occurred as well as receiving audio and voice messages. The ability to listen as well as emit voice messages at the site where detection has occurred may be used to confirm that a graffiti-making act took place and is not, for example, an owner or city employee lawfully spray painting a surface. The ability to listen may be used to record voice or other sound activity as evidence for a later criminal proceeding, e.g., record voice of the perpetrator that committed the graffiti. The ability to emit an audio and voice message may also be used to confront the perpetrator.

The electronics 210 of the base unit 120 may include an automatic location identification device 350 such as a Global Positioning System ("GPS") device for automatically identifying the location of the base unit 120. Alternatively, the base unit 120 may include a broadcasting mechanism 360 that broadcasts a signal from which the location of the system 100 can be identified and/or that a graffiti-making act 130 has been committed.

If the one or more sensors 110 are wireless, the base unit 120 preferably includes one or more receivers 370 for receiving the respective signal(s) and transmitting the signal(s) to the electronics 210 of the base unit 120.

The base unit 120 is preferably powered by one or more batteries 380, but may be powered by any well-known internal or external power source. If the battery 380 gets low, the electronics 210 may cause the communication device 340 to communicate to one or more entities responsible for replacing the battery 380 that the battery 380 is low and needs to be replaced.

Although the detection system 100 has been described above in conjunction with detection of a graffiti-making act, it will be readily apparent to those skilled in the art that the detection system 100 may be used in other applications to detect other occurrences, besides detecting graffiti.

For example, with reference to FIG. 4A, a detection system 500, which is similar in construction to the detection system 100 described above, may be used to detect the report of a firearm shot 510 from a firearm 520, e.g., a handgun, automatic weapon, rifle, etc., of a perpetrator 530, and an initiate an alarm in response thereto. In the past, when a crime was committed, the police would often show up at the scene of the crime without knowing whether the perpetrator(s) 530 were still in the area of crime scene, and, if so, whether the perpetrator(s) 530 were carrying a lethal weapon such as a firearm 520 that had been discharged. If the police knew one or more shots of a firearm had occurred at a crime scene, the police would know that investigating the crime may be dangerous. The police could prepare accordingly and alert the appropriate medical agencies. Thus, the inventors of the firearm shot detection system and method recognized that such a system and method could detect whether a firearm shot had occurred and alert the police accordingly.

The firearm shot detection system 500 illustrated in FIG. 4A is for fixed use, i.e., the object that the firearm detection system 500 is mounted to is not designed to move or be mobile, such as in possible armed robbery situations. For example, the firearm shot detection system 500 may be mounted to a wall 540 or counter 545 of an establishment 550, e.g., a convenience store such as 7-Eleven™, a jewelry store, a bank, a fast-food restaurant, a home, or any other establishment susceptible to an robbery, accidents, or violence involving a firearm. FIG. 4A illustrates an employee 560 such as a clerk behind the counter 545 of the establishment 550.

The firearm shot detection system 500 includes a base unit 570 and one or more sensors 580. Instead of the one or more sensors 110 and/or base unit 120 described above with respect to FIGS. 1-3 being configured to determine whether the sound signature of an act such as a graffiti-making act occurred, the one or more sensors 580 and/or base unit 570 determine whether the sound signature of a firearm shot 510 occurred. In FIG. 4A, a single sonic sensor 580 is illustrated as being integrated with the base unit 570. As described above, in an alternative embodiment, the one or more sensors 580 may be separate or remote from the base unit 570.

Because the firearm shot detection system 500 is so similar in construction to the graffiti detection system 100 described above, further details as to the construction or structure of the firearm shot detection system 500 will not be described in additional detail. The discussion above with respect to the construction of the graffiti detection system 100 is equally applicable to the firearm shot detection system 500, and is thereby incorporated by reference.

An embodiment of a method of using the firearm shot detection system 500 will now be described. During a hold-up, burglary, robbery, etc., the perpetrator 530 of the crime (or the employee 560 of the establishment 550 in defense) may fire a firearm 120 such as a handgun, automatic weapon, rifle, etc. The report of the firearm shot 510 includes sound waves having a characteristic sound signature frequency or frequency pattern. A firearm shot 510 from each type of firearm, e.g., handgun, automatic weapon, rifle, etc., and each brand of firearm, e.g., Smith & Wesson™, Colt™, etc. has a unique sound signature frequency or frequency pattern similar to each different graffiti-making acts having a unique sound signature frequency or frequency pattern, as described above. The one or more sensors 580 convert the sound from the firearm shot 510 into an electronic signal or electronic signals that are processed by the electronics 210 in the base unit 570 for determining whether the electronic signal(s) are from a firearm shot 510 using any of the techniques described above or any other well-known technique used in sound signature analysis. If it is determined that the electronic signal(s) represents a firearm shot, one or more alarms are initiated. The one or more alarms may include one or more of the alarms described above with respect to the

graffiti detection system 100 and method. One type of alarm that may be initiated upon detection of a firearm shot 510 is the locking of one or more automatic locking mechanisms for one or more doors 590. This may be desirable, for example, to lock the perpetrator 530 in an area between a pair of door 590 assuming that no innocent bystanders are in this detaining area with the perpetrator. Preferably, the one or more alarms include actuating a communication to an entity or location such as a police dispatcher, one or more police officers in the area, and/or a security system center alerting the entity that a firearm shot 510 was detected at the location of the establishment. Communicated information may include, but not by way of limitation, a firearm shot 520 was detected, the location of the firearm shot, the time of the firearm shot, the number of firearm shots detected, and/or the type of firearm shot. Thus, the firearm detection system 500 detects the sound signature of the report of one or more firearm shots, and may automatically alert the police in response thereto.

With reference to FIG. 4B, in another embodiment of the invention, a firearm shot detection system 600 similar to the firearm shot detection system 500 described above may be mounted to a mobile object 610 or be part of the mobile object 610. Examples of mobile objects include, but not by way of limitation, a police car, a police motorcycle, an armed money truck, an emergency vehicle, a limousine, an expensive car, a navigational system such as a GPS system, a wireless phone, a wireless internet device, a radio communication system, and any other portable communication device. Police officers are often shot at when investigating a crime or in the process of making an arrest. If a police officer is alone and is shot, the police officer may not be found in time for appropriate medical care to arrive. Further, if the police officer becomes engaged in a gun fight with one or more perpetrators, the police officer may not be able to radio a police dispatcher or other police officers for assistance without the risk of getting shot or allowing the one or more perpetrators to escape.

FIG. 4B illustrates a number of exemplary embodiments of and locations for the firearm shot detection system 600. For example, the firearm shot detection system 600 may be mounted on a mobile object 610 such as a police car driven by a police officer 620. The firearm shot detection system 600 may be in the vehicle, as part of a radio

communication system of the police car. The firearm shot detection system 600 may also be a wearable device or part of a wearable device such as part of a mobile object 610 that is a two-way radio. Similar to the firearm shot detection system 500 described above, the firearm shot detection system 600 detects the sound signature from the report of a firearm shot from a firearm 630 of a perpetrator 640, and may initiate one or more of the alarms described above. Preferably, the firearm shot detection system 600 will automatically communicate with a police dispatcher that a firearm shot has been detected. If the firearm shot detection system 600 is part of a communication device such as two-way radio or wireless phone, the firearm shot detection system 600 may communication with one or more entities such as a police dispatcher using the existing communication device. Similar to the detection system 100 described above, the firearm shot detection system 600 may include an automatic location identification device such as a GPS device for automatically identifying the location of the firearm shot detection system 600, and, hence, the general location of the firearm shot detected. The firearm shot detection system 600 may automatically report to the police dispatcher one or more of the following: a firearm shot was detected, the location of the firearm shot, the time of the firearm shot, the number of firearm shots detected, and/or the type of firearm shot.

With reference to FIG. 5, another application of the detection system will now be described. A detection system 700 similar to the detection system 100 described above may be used to detect a tire leak 710 from a tire 725 of a vehicle 720 such as a truck 730 and/or trailer 740 and initiate an alarm in response thereto. A damaged or blown tire 725 can be a dangerous hazard for the driver of a vehicle 720 and/or other drivers on the road in the vicinity of the vehicle. For example, a blown tire from a large truck can cause the truck to swerve erratically and jackknife. Not only is this dangerous for the driver and any passengers of the truck, but it poses a real hazard to surrounding vehicles. The swerving truck may collide with other vehicles on the road or may cause vehicles to swerve, increasing the probability of one or more vehicle accidents. Further, if the blown tire remains on the road, vehicles may swerve to miss the tire or may collide with the tire, increasing the probability of additional vehicle accidents.

A blown or severely damaged tire usually results from a small hole or tear in the tire 725. This small hole or tear usually emits a leaking noise 710 caused by compressed air escaping the small hole or tear in the tire 725. If a vehicle driver and/or dispatcher, e.g., truck dispatcher, knew of a tire leak 710 in one of the tires 725 of the vehicle 720, the driver could have the tire repaired, replaced, or take the necessary precautions. Thus, the inventors of the vehicle tire leak detection system 700 and method recognized that such a system and method could detect whether a tire leak 710 had occurred and alert the vehicle driver and/or dispatcher accordingly.

The tire leak detection system 700 includes a base unit 750 and one or more sensors 760. Instead of the one or more sensors 110 and/or base unit 120 described above with respect to FIGS. 1-3 being configured to detect whether the sound signature of a graffiti-making act occurred, the one or more sensors 760 and/or base unit 750 may detect whether the sound signature of a tire leak 710 occurred.

It should be noted, the one or more sensors 760 and/or base unit 750 may determine whether a tire 725 is going flat by detecting sounds indicative of a tire going flat other than a tire leak 710. For example, as a tire 725 goes flat, a unique noise may be made as the tire 725 contacts the road, e.g., the tire may make a slapping sound of a detectable characteristic frequency or frequencies. This sound or other sounds may be the basis of determining whether a tire 725 is going flat.

The base unit 750 may be mounted to the vehicle 720 in a strategic location such as, but not by way of limitation, a rear side 770 of a cab 780 if the vehicle 720 is a truck or somewhere on a chassis 790 of the vehicle 720. Similarly, the one or more sensors 760 may be mounted to the vehicle 720 in a strategic location such as, but not by way of limitation, on the chassis 790 of the vehicle 720, adjacent the tires 725. As described above, the one or more sensors 760 may be integrated with the base unit 750 or separate therefrom. Because the tire leak detection system 700 is so similar in construction to the graffiti detection system 100 described above, further details as to the construction or structure of the tire leak detection system 700 will not be described in additional detail. The discussion above with respect to the construction of the graffiti

detection system 100 is equally applicable to the tire leak detection system 700, and is thereby incorporated by reference.

An embodiment of a method of using the tire leak detection system 700 will now be described. It is common for the tire 725 of a vehicle 720 to become damaged during normal use by sharp objects such a nails, glass, etc. A cut or hole in the tire 725 caused by the sharp object may cause a leak 710. The tire leak 710 is a precursor to further tire damage, and a potential multiple vehicle accident, as described above. The tire leak 710 emits sound waves having a characteristic sound signature frequency or frequency pattern. The tire leak 710 may have a unique sound signature frequency or frequency pattern for different types of leaks, at different tire pressures, for different types of tires, etc.

The one or more sensors 760 convert the sound from the tire leak 710 into an electronic signal or electronic signals that are processed by the electronics 210 in the base unit 750 to determine whether the electronic signal(s) represent one or more different types of tire leaks. If it is determined that the electronic signal(s) represents a tire leak, one or more alarms are initiated. The one or more alarms may include one or more of the alarms described above with respect to the graffiti detection system 100 and method. Preferably, the one or more alarms include a communication to the driver of the vehicle 720 alerting the driver that a tire leak 710 has been detected. If the vehicle 720 is a large truck 730 and/or trailer 740, an additional alarm may include a communication to a truck dispatcher alerting the dispatcher that a tire leak 710 has been detected.

Similar to the detection system 100 described above, the tire leak detection system 700 may include an automatic location identification device such as a GPS device for identifying the location of the tire leak detection system 700, and, hence, the location of the vehicle.

Reported information to the driver and/or dispatcher may include, but not by way of limitation, a tire leak has been detected, the time of the tire leak, the wheel that the leak is from, the location of the vehicle, and/or the type of tire leak. Thus, the tire

leak detection system 700 detects the sound of one or more tire leaks 710 of a vehicle 720, and automatically alerts the driver and/or the dispatcher in response thereto.

With reference to FIG. 6, another application of the detection system will now be described. Problems can occur as a result of conduct or acts that cause the emission of a sound of a characteristic frequency or frequencies. If the conduct or act could be detected and reported immediately, the frequency of the resulting problem may be eliminated or reduced. An exemplary scenario is the unauthorized use by an unauthorized co-worker or other individual 800 of an authorized individual's equipment. A detection system 810 similar to the detection system 100 described above may be used to detect a sound or other characteristic 820 indicative of the use of equipment 830 such as a computer, cash register, copy machine or any other equipment one wishes to protect or prevent the unauthorized use of and initiate an alarm in response thereto.

During operation or use of equipment 830, especially electronic equipment, one or more sounds or other characteristics 810 occur that indicate the equipment 830 is being used. Examples include, but not by way of limitation, one or more beeps from a computer upon start-up, the ring of a cash register when a the register drawer is opened, the humming of a fan or hard drive in a computer, the transmittance of signals in a computer, the typing on a computer keyboard, the dialing or connecting sound of a facsimile machine, and the noise emitted during the scanning step of a copy machine. If an authorized individual, employer, etc. knew the equipment 830 was being used without authorization, the necessary precautions, remedial action, etc. could be taken. Thus, the inventors of the equipment use detection system 810 and method recognized that such a system and method could detect whether one or more sounds or other characteristics 820 indicative of equipment use had occurred and alert the authorized individual, employer, etc. accordingly.

The equipment use detection system 810 includes a base unit 840 and one or more sensors 850. Instead of the one or more sensors 110 and/or base unit 120 described above with respect to FIGS. 1-3 being configured to detect whether the sound signature of a graffiti-making act occurred, the one or more sensors 850 and/or base

unit 840 may detect whether one or more sounds or other characteristics 810 indicative of equipment use occurred.

The base unit 840 and one or more sensors 850 (if the one or more sensors 850 are separate from the base unit 840) are preferably mounted in one or more strategic locations that are inconspicuous and where they are not likely to be tampered with or damaged. In one embodiment, the base unit 840 and one or more sensors 850 are not connected directly to the equipment 830 being monitored, inhibiting the unauthorized individual 800 from spotting the equipment. The base unit 840 could be mounted on a wall 860, under a desk or table 870, or any other strategic location. As described above, the one or more sensors 850 may be integrated with the base unit 840 or separate therefrom. Because the equipment use detection system 810 is so similar in construction to the graffiti detection system 100 described above, further details as to the construction or structure of the equipment use detection system 810 will not be described in additional detail. The discussion above with respect to the construction of the graffiti detection system 100 is equally applicable to the equipment use detection system 810, and is thereby incorporated by reference.

An embodiment of a method of using the equipment use detection system 810 will now be described. The equipment 830 may emit sound waves 820 having a characteristic sound signature frequency or frequency pattern. Different types of equipment use may cause different sounds having a unique sound signature frequency or frequency pattern. Further, the same type of equipment 830 may emit different sounds indicative of equipment use.

The one or more sensors 850 may include one or more sonic sensors that convert the sound from the equipment use into an electronic signal or electronic signals that are processed by the electronics 210 in the base unit 840 to determine whether the electronic signal(s) represent one or more different types of equipment use. If it is determined that the electronic signal(s) represents equipment use, one or more alarms are initiated. The one or more alarms may include one or more of the alarms described above with respect to the graffiti detection system 100 and method. Preferably, the one or more alarms include a communication to the authorized individual, the employer,

security, police, etc. indicating that equipment use has been detected. An additional type of alarm that may be initiated if, for example, the equipment 830 is electronic is an automatic shut-down mechanism that shuts down, e.g., cuts power to, the equipment 830.

Similar to the detection system 100 described above, the equipment use detection system 810 may include an automatic location identification device such as a GPS device for identifying the location of the equipment use detection system 810. Such an automatic location identification device may be desirable if the equipment is of a mobile nature such as an automobile.

Reported information to the authorized individual, the employer, security, police, etc. may include, but not by way of limitation, an equipment use has been detected, the time of the equipment use, the type of equipment use, and/or the location of the equipment use. Thus, the equipment use detection system 810 detects the use of one or more different types of equipment use, and automatically alerts the authorized individual, the employer, security, police, etc. in response thereto.

The detection system 810 may be used to detect the use of electronic and non-electronic equipment 830. Further, the one or more sensors 850 may include one or more types of sensors other than sonic sensors that detect use of the equipment other than through detection of an emitted sound. For example, the one or more sensors could determine that a carbon monoxide detector has been actuated and communicate this to one or more entities in the manner described above.

In another scenario, instead of the detection system 810 detecting and reporting the act of equipment use, the detection system 810 may detect and report other acts such as the conduct of a baby crying. With more and more parents becoming full-time working parents, the need for baby or childcare has increased dramatically in recent years. One of the biggest concerns of parents who have hired full or part-time baby or childcare is that their baby or child be treated properly by the childcare. This has been an increasing concern in recent times with the numerous reports of nannies severely abusing babies. In another embodiment, the detection system 810 may be adapted to detect and report an act of interest such as the crying of a baby. The one or more

sensors 850 may pick up the characteristic frequency or frequencies or a baby's cry and the base unit 840 may process the signal(s) to determine if the signal(s) correspond to a baby's cry, and, if so, initiate one or more alarms. One alarm may be communicating to one or both of the parents that the baby is crying. This communication may be made by any well-known manner, e.g., e-mail, page, telephone call, cellphone call, videophone call, etc. The parent(s) could then check on the baby's condition by, for example, contacting the hired childcare, viewing a video image of the baby transmitted by the communication or by other means, etc.

Although the detection system has been described in conjunction with detecting a graffiti-making act, a firearm shot, a vehicle tire leak, and an act or conduct such as equipment use and the crying of a baby, and actuating an alarm in response thereto, it will be readily apparent to those skilled in the art that the detection system described above may be used in other applications such as, but not by way of limitation.

While preferred methods and embodiments have been shown and described, it will be apparent to one of ordinary skill in the art that numerous alterations may be made without departing from the spirit or scope of the invention. Therefore, the invention is not to be limited except in accordance with the following claims.

I CLAIM:

1. A method of detecting a graffiti-making act, comprising:
sonically detecting the graffiti-making act;
initiating an alarm indicating that the graffiti-making act took place.

2. The method of claim 1, wherein sonically detecting the graffiti-making act includes sonically detecting the spraying noise of a spray can.

3. The method of claim 1, wherein sonically detecting the graffiti-making act includes sonically detecting the sound made by writing with a felt-marker pen on a surface.

4. The method of claim 1, wherein sonically detecting the graffiti-making act includes sonically detecting the sound made by scratching an abrasive instrument on a surface.

5. The method of claim 4, wherein the abrasive instrument is a member from the group consisting of a stone, a gem, a screwdriver, and a glass cutter.

6. The method of claim 1, wherein sonically detecting the graffiti-making act includes sonically detecting the graffiti-making act with a sensor selected from the group consisting of a piezoelectric sensor, a dynamic sensor, an electret sensor, a carbon sensor, a bolometer sensor, an optical reflection sensor, a capacitive sensor, an inductive sound sensor, and an ultrasonic sensor.

7. The method of claim 1, wherein sonically detecting the graffiti-making act includes detecting the sound spectrum pattern of the graffiti-making act.

8. The method of claim 1, wherein sonically detecting the graffiti-making act further includes sonically focusing sound produced from the graffiti-making act.

9. The method of claim 8, wherein sonically focusing sound produced from the graffiti-making act includes sonically focusing the sound with a member selected from the group consisting of phase arrays, reflectors, and lenses.

10. The method of claim 8, wherein sonically focusing sound produced from the graffiti-making act includes de-selecting other similar sounds that may effect a false alarm.

11. The method of claim 10, wherein de-selecting includes baffling sound.

12. The method of claim 1, wherein sonically detecting includes filtering sound spectral characteristics of sound from said graffiti-making act.

13. The method of claim 1, wherein sonically detecting includes filtering using a technique from the group consisting of duration and time coding of the sound, digital code quantitization, digitized algorithm analysis, and Fourier Transform analysis.

14. The method of claim 1, wherein the alarm is a member from the group consisting of a bell, a light, a horn, a speaker, a marking means, a camera to record the activity, a camera to monitor the activity, a photo process, a phone device, a wireless communication device, a cage, a trap, and a disabling means.

15. The method of claim 1, further including confirming that a graffiti-making act took place with one or more additional sensors.

16. The method of claim 15, wherein the one or more sensors are a member from the group consisting of a motion detector and a heat detector.

17. A method of detecting a graffiti-making act of spraying with a spray paint can, comprising:

sonically detecting a spraying noise made from the spray paint can using one or more sonic sensors;

communicating that a graffiti-making act has been detected to one or more entities.

18. A method of detecting a graffiti-making act, comprising:

detecting a graffiti-making act using one or more sensors;

communicating that a graffiti-making act has been detected to one or more entities.

19. The method of claim 18, wherein detecting a graffiti-making act includes sensing an odor spectrum pattern of the graffiti-making act with an olfactory sensor, and using electronic spectral analysis to determine that a graffiti-making act occurred.

20. The method of claim 18, wherein detecting a graffiti-making act includes sonically sensing a sound spectrum pattern of the graffiti-making act with a sonic sensor, and using electronic spectral analysis to determine that a graffiti-making act occurred.

21. The method of claim 20, wherein the graffiti-making act includes spraying with a spray paint can, and sonically sensing includes sonically sensing a spraying noise of the spray paint can.

22. The method of claim 20, wherein the graffiti-making act includes spraying with a spray paint can, and sonically sensing includes sonically sensing a rattling noised caused by shaking the spray paint can to mix paint inside the spray paint can.

23. The method of claim 20, wherein the graffiti-making act includes writing with a felt-marker pen on a surface, and sonically sensing includes sonically sensing a sound made by writing with a felt-marker pen on a surface.

24. The method of claim 20, wherein the graffiti-making act includes scratching with an abrasive instrument on a surface, and sonically sensing includes sonically sensing the sound made by scratching with an abrasive instrument on a surface.

25. The method of claim 18, further including confirming that a graffiti-making act took place with at least one motion detector to detect movement of a perpetrator of the graffiti-making act.

26. The method of claim 18, further including confirming that a graffiti-making act took place with at least one heat detector to detect body heat of a perpetrator of the graffiti-making act.

27. The method of claim 18, further including confirming that a graffiti-making act took place with at least one sonic detector to detect a sound of the graffiti-making act.

28. The method of claim 18, further including confirming that a graffiti-making act took place with at least one olfactory detector to detect an odor of the graffiti-making act.

29. The method of claim 18, wherein detecting a graffiti-making act includes amplifying a signal from said at least one sensor to a distinguishable level, combining the signal with a predetermined signature signal, reducing signal noise, and determining whether the resulting signal includes a spectrum pattern matching a predetermined spectrum pattern of one or more graffiti-making acts for a predetermined period of time.

30. The method of claim 18, wherein communicating to one or more entities includes communicating to a police dispatcher.

31. The method of claim 18, wherein communicating to one or more entities includes communicating to one or more police officers on patrol in a general area of the graffiti-making act.

32. The method of claim 18, wherein communicating to one or more entities includes communicating to an owner of a property where the graffiti-making act took place.

33. The method of claim 18, wherein communicating to one or more entities includes communicating to a security system center.

34. The method of claim 18, wherein communicating to one or more entities includes dialing one or more predetermined phone numbers.

35. The method of claim 18, wherein communicating to one or more entities includes communicating one or more of the following: a graffiti-marking act has been detected, the location of the graffiti-marking act, the type of graffiti-marking act, the time the graffiti marking act took place.

36. The method of claim 18, wherein detecting a graffiti-making act includes detecting a graffiti-making act using one or more sensors and a base unit powered by a battery, the method further including communicating to one or more entities that the battery is low and needs to be replaced.

37. The method of claim 18, wherein said one or more sensors communicate wirelessly with a base unit, and detecting a graffiti-making act includes transmitting a signal representative of the graffiti-making act to the base unit for processing of the signal.

38. The method of claim 18, wherein detecting the graffiti-making act includes detecting one or more different graffiti-making acts with one or more different types of sensors.

39. The method of claim 18, wherein detecting the graffiti-making act includes detecting multiple graffiti-making acts with a single sensor.

40. A graffiti detection system for detecting a graffiti-making act, comprising:

one or more sensors adapted to sense the graffiti-making act and transmit a signal representative of the graffiti-making act; and

a base unit including

electronics adapted to process the signal and determine whether the signal represents a graffiti-making act; and

a communication device coupled to the electronics and adapted to communicate to one or more entities that a graffiti-making act has been detected.

41. The system of claim 40, wherein said one or more sensors include one or more olfactory sensors adapted to sense an odor spectrum pattern of the graffiti-making act and transmit a signal representative of the odor spectrum pattern of the graffiti-making act, and said electronics adapted to process the signal to determine if the odor spectrum pattern represents a graffiti-making act.

42. The system of claim 40, wherein said one or more sensors include one or more sonic sensors adapted to sense a sound spectrum pattern of the graffiti-making act and transmit a signal representative of the sound spectrum pattern of the graffiti-making act, and said electronics adapted to process the signal to determine if the sound spectrum pattern represents a graffiti-making act.

43. The system of claim 42, wherein said one or more sonic sensors are adapted to sense a spraying noise of a spray can.

44. The system of claim 42, wherein said one or more sonic sensors are adapted to sense a rattling noised caused by shaking a spray paint can to mix paint inside the spray paint can.

45. The system of claim 42, wherein said one or more sonic sensors are adapted to sense the sound made by writing with a felt-marker pen on a surface.

46. The system of claim 42, wherein said one or more sonic sensors are adapted to sense a sound made by scratching with an abrasive instrument on a surface.

47. The system of claim 40, further including a motion detecting sensor adapted to detect movement of a perpetrator of the graffiti-making act for confirming that a graffiti-making act took place.

48. The system of claim 40, further including a heat detecting sensor adapted to detect body heat of a perpetrator of the graffiti-making act for confirming that a graffiti-making act took place.

49. The system of claim 40, further including an olfactory detector adapted to detect an odor of the graffiti-making act for confirming that a graffiti-making act took place.

50. The system of claim 40, further including a sonic detector adapted to detect a sound of the graffiti-making act for confirming that a graffiti-making act took place.

51. The system of claim 40, wherein said electronics include a pre-amplifier adapted to amplify the signal from said at least one sensor to a distinguishable level, a mixer adapted to combine the signal with a predetermined signature signal, a low-pass filter and a precision rectifier adapted to reduce signal noise, and a time domain characterization mechanism adapted to determine whether the resulting signal represents a graffiti-making act for a predetermined period of time.

52. The system of claim 51, wherein said time domain characterization mechanism includes a charge pump.

53. The system of claim 51, wherein said time domain characterization mechanism includes a quantitative characterization device such as a microprocessor to determine whether the resulting signal includes a spectrum pattern matching a predetermined spectrum pattern of one or more graffiti-making acts for a predetermined period of time.

54. The system of claim 40, wherein said communication device is adapted to communicate with a police dispatcher.

55. The system of claim 40, wherein said communication device is adapted to communicate with one or more police officers on patrol in a general area of the graffiti-making act.

56. The system of claim 40, wherein said communication device is adapted to communicate with an owner of the property where the graffiti-making act took place.

57. The system of claim 40, wherein said communication device is adapted to communicate with a security system center.

58. The system of claim 40, wherein said communication device is adapted to dial one or more predetermined phone numbers.

59. The system of claim 40, wherein said base unit is adapted to be powered by a battery, and said communication device is adapted to communicate to one or more entities that the battery is low and needs to be replaced.

60. The system of claim 40, wherein said one or more sensors are adapted to communicate wirelessly with said base unit.

61. The system of claim 40, wherein said one or more sensors are adapted to communicate with said base unit through wired means.

62. The system of claim 40, wherein said one or more sensors are integral with said base unit.

63. The system of claim 40, wherein said one or more sensors include one or more different types of sensors adapted to sense one or more different types of graffiti-making acts.

64. The system of claim 40, wherein said one or more sensors are one or more sonic sensors adapted to sense a broad range of sound frequencies.

65. The system of claim 40, wherein said one or more sensors are one or more sonic sensors adapted to sense sound frequencies or a sound frequency that is the same as or similar to that of the sound of one or more specific graffiti-making acts.

66. The system of claim 40, wherein said one or more sensors include a single sensor adapted to sense more than one different types of graffiti-making acts.

67. The system of claim 40, wherein said one or more sensors include one or more of the following types of sensors: a piezoelectric sensor, a dynamic sensor, an electret sensor, a carbon sensor, a bolometer sensor, an optical reflection sensor, a capacitive sensor, an inductive sound sensor, and an ultrasonic sensor.

68. The system of claim 40, wherein said one or more sonic sensors are adapted to sense the sound of a graffiti-making act up to a distance of 400 feet.

69. The system of claim 40, wherein said one or more sonic sensors are adapted to send either a 900 megahertz or a spread spectrum signal.

70. The system of claim 40, wherein said electronics are adapted to filter sound using a technique from the group consisting of duration and time coding of the sound, digital code quantitization, digitized algorithm analysis, and Fourier Transform analysis.

71. The system of claim 40, wherein said base unit includes an alarm selected from the group consisting of a bell, a light, a horn, a whistle, a speaker, a marking means, a camera to record the activity, a camera to monitor the activity, sprinkler, a cage, a trap, and a disabling means.

72. A graffiti detection system for detecting a graffiti-making act, comprising:

means for sensing a graffiti-making act and transmitting a signal representative of the graffiti-making act; and

a base unit including

means for determining whether the signal represents a graffiti-making act; and

means for communicating to one or more entities that a graffiti-making act has been detected.

73. A method of detecting a firearm shot, comprising:

sonically detecting the firearm shot using one or more sonic sensors;

initiating an alarm indicating that the firearm shot took place.

74. The method of claim 73, wherein sonically detecting the firearm shot includes sonically detecting a shot of one or more different firearms.

75. The method of claim 73, wherein sonically detecting the firearm shot includes sonically detecting the firearm shot with a sensor selected from the group consisting of a piezoelectric sensor, a dynamic sensor, an electret sensor, a carbon sensor, a bolometer

sensor, an optical reflection sensor, a capacitive sensor, an inductive sound sensor, and an ultrasonic sensor.

76. The method of claim 73, wherein sonically detecting the firearm shot includes detecting a sound spectrum pattern of the firearm shot.

77. The method of claim 73, wherein sonically detecting the firearm shot includes sonically detecting the firearm shot with one or more sonic sensors mounted to a fixed object.

78. The method of claim 73, wherein sonically detecting the firearm shot includes sonically detecting the firearm shot with one or more sonic sensors mounted to a movable object.

79. The method of claim 73, further including determining the location of the firearm shot using an automatic location identification device and communicating the location of the firearm shot to the police.

80. The method of claim 73, wherein sonically detecting includes filtering sound spectral characteristics of sound from said firearm shot.

81. The method of claim 73, wherein sonically detecting includes filtering using a technique from the group consisting of duration and time coding of the sound, digital code quantitization, digitized algorithm analysis, and Fourier Transform analysis.

82. The method of claim 73, wherein the alarm is a member from the group consisting of a bell, a light, a horn, a speaker, a marking means, a camera to record the activity, a camera to monitor the activity, a photo process, a phone device, a wireless communication device, a cage, a trap, an automatic locking door, and a disabling means.

83. The method of claim 73, wherein initiating an alarm includes communicating to one or more entities that a firearm shot occurred.

84. The method of claim 83, wherein communicating to one or more entities includes communicating to a police dispatcher.

85. The method of claim 83, wherein communicating to one or more entities includes communicating to one or more police officers in an area near where the firearm shot occurred.

86. The method of claim 83, wherein communicating to one or more entities includes communicating to a security system center.

87. The method of claim 83, wherein communicating to one or more entities includes dialing one or more predetermined phone numbers.

88. The method of claim 83, further including communicating one or more of the following to the one or more entities: a firearm shot has been detected, the location of the firearm shot, the type of firearm shot, the time of the firearm shot.

89. The method of claim 73, wherein detecting a firearm shot includes detecting a firearm shot using one or more sensors and a base unit powered by a battery, the method further including communicating to one or more entities that the battery is low and needs to be replaced.

90. The method of claim 73, wherein said one or more sensors communicate wirelessly with a base unit, and detecting a firearm shot includes transmitting a signal representative of the firearm shot to the base unit for processing of the signal.

91. The method of claim 73, wherein detecting the firearm shot includes detecting one or more different types of firearm shots with one or more different types of sonic sensors.

92. The method of claim 73, further including confirming that a firearm shot took place with one or more additional sensors.

93. The method of claim 92, wherein the one or more additional sensors are a member from the group consisting of a motion sensor and a heat sensor.

94. The method of claim 73, wherein detecting a firearm shot includes determining whether a sound spectrum pattern of a firearm shot matches a sound spectrum pattern of one or more a predetermined stored fire arm shot sound spectrum patterns.

95. The method of claim 73, further including amplifying a signal from said at least one sonic sensor to a distinguishable level, combining the signal with a predetermined signature signal, reducing signal noise, and determining whether the resulting signal represents one or more predetermined types of firearm shots for a predetermined period of time.

96. A firearm shot detection system for detecting a firearm shot, comprising:

one or more sonic sensors adapted to sonically sense the firearm shot and transmit a signal representative of the sound of the firearm shot; and

a base unit including

electronics adapted to receive the signal and process the signal to determine if the signal represents one or more predetermined firearm shots; and

a communication device coupled to the electronics and adapted communicate to one or more entities that a firearm shot has been detected.

97. The system of claim 96, further including a motion detecting sensor adapted to sense movement of a shooter of the firearm shot for confirming that a firearm shot took place.

98. The system of claim 96, further including a heat detecting sensor adapted to sense body heat of a shooter of the firearm shot for confirming that a firearm shot took place.

99. The system of claim 96, wherein said electronics include a pre-amplifier adapted to amplify the signal from said at least one sensor to a distinguishable level, a mixer adapted to combine the signal with a predetermined signature signal, a low-pass filter and a precision rectifier adapted to reduce signal noise, and a time domain characterization mechanism adapted to determine whether the resulting signal represents one or more different types of firearm shots for a predetermined period of time.

100. The system of claim 99, wherein said time domain characterization mechanism includes a charge pump.

101. The system of claim 99, wherein said time domain characterization mechanism includes a quantitative characterization device, quantitative characterization device including a microprocessor to determine whether the resulting signal includes a spectrum pattern matching a predetermined spectrum pattern of one or more firearm shots for a predetermined period of time.

102. The system of claim 96, wherein said communication device is adapted to communicate with a police dispatcher.

103. The system of claim 96, wherein said communication device is adapted to communicate with one or more police officers near an area of said firearm fire shot.

104. The system of claim 96, wherein said communication device is adapted to communicate with a security system center.

105. The system of claim 96, wherein said communication device is adapted to dial one or more predetermined phone numbers.

106. The system of claim 96, wherein said base unit is adapted to be powered by a battery, and said communication device is adapted to communicate to one or more entities that the battery is low and needs to be replaced.

107. The system of claim 96, wherein said one or more sensors are adapted to communicate wirelessly with said base unit.

108. The system of claim 96, wherein said one or more sensors are adapted to communicate with said base unit through wired means.

109. The system of claim 96, wherein said one or more sensors are integral with said base unit.

110. The system of claim 96, wherein said one or more sensors include one or more different types of sensors adapted to sense one or more different types of firearm shots.

111. The system of claim 96, wherein said one or more sensors are one or more sonic sensors adapted to sense a broad range of sound frequencies.

112. The system of claim 96, wherein said one or more sensors are one or more sonic sensors adapted to sense sound frequencies or a sound frequency that is the same as or similar to that of the sound of one or more specific of firearm shots.

113. The system of claim 96, wherein said one or more sensors include a single sensor adapted to sense more than one different type of firearm shot.

114. The system of claim 96, wherein said one or more sensors include one or more different types of sensors.

115. The system of claim 96, wherein said one or more sensors include one or more of the following types of sensors: a piezoelectric sensor, a dynamic sensor, an electret sensor, a carbon sensor, a bolometer sensor, an optical reflection sensor, a capacitive sensor, an inductive sound sensor, and an ultrasonic sensor.

116. The system of claim 96, wherein said electronics are adapted to filter sound using a technique from the group consisting of duration and time coding of the sound, digital code quantitization, digitized algorithm analysis, and Fourier Transform analysis.

117. The system of claim 96, wherein said base unit includes an alarm selected from the group consisting of a bell, a light, a horn, a speaker, a marking means, a camera to record the activity, a camera to monitor the activity, a photo process, a cage, a trap, an automatic locking door and a disabling means.

118. The system of claim 96, wherein said system is adapted to be mounted to a movable object, said base unit includes an automatic location identification device for identifying the location of said system, and said communication device is adapted to communicate the location of the firearm shot to one or more entities.

119. The system of claim 96, wherein said communication device is adapted to communicate one or more of the following to one or more entities: a firearm shot has been detected, the location of the firearm shot, the time of the firearm shot, and the type of the firearm shot.

120. A method of detecting a leak of a vehicle tire, comprising:
detecting a leak of a vehicle tire using one or more sonic sensors;
initiating an alarm indicating that the tire leak took place.

121. The method of claim 120, wherein detecting the leak of a vehicle tire includes sonically detecting one or more different types of vehicle tire leaks.

122. The method of claim 120, wherein detecting the leak of a vehicle tire includes sonically detecting the leak of a vehicle tire with a sensor selected from the group consisting of a piezoelectric sensor, a dynamic sensor, an electret sensor, a carbon sensor, a bolometer sensor, an optical reflection sensor, a capacitive sensor, an inductive sound sensor, and an ultrasonic sensor.

123. The method of claim 120, wherein detecting the leak of a vehicle tire includes detecting a sound spectrum pattern of the leak of a vehicle tire.

124. The method of claim 120, wherein detecting the leak of a vehicle tire includes detecting the leak of a vehicle tire with one or more sonic sensors mounted to a vehicle.

125. The method of claim 120, wherein detecting the leak of a vehicle tire includes detecting the leak of a truck tire and/or trailer tire.

126. The method of claim 120, wherein detecting a leak of a vehicle tire includes filtering a signal from said one or more sensors using a technique from the group consisting of duration and time coding, digital code quantitization, digitized algorithm analysis, and Fourier Transform analysis.

127. The method of claim 120, wherein initiating an alarm includes communicating to a driver of the vehicle that a vehicle tire leak has taken place.

128. The method of claim 120, wherein initiating an alarm includes communicating to a vehicle dispatcher that a vehicle tire leak has taken place.

129. The method of claim 120, wherein initiating an alarm includes communicating to one or more entities one or more of the following: a vehicle tire leak has been detected, the vehicle that the tire leak has been detected from, the location of the vehicle tire that the tire leak has been detected from, the type of vehicle tire leak, and the time of the vehicle tire leak.

130. The method of claim 120, wherein detecting a vehicle tire leak includes detecting a vehicle tire leak using one or more sensors and a base unit powered by a battery, the method further including communicating to one or more entities that the battery is low and needs to be replaced.

131. The method of claim 120, wherein said one or more sensors communicate wirelessly with a base unit, and detecting a leak of a vehicle tire includes transmitting a signal representative of the leak of a vehicle tire to the base unit for processing of the signal.

132. The method of claim 120, wherein detecting a tire leak includes determining whether a tire leak occurred using electronic spectral analysis.

133. The method of claim 120, wherein detecting a tire leak includes amplifying a signal from said at least one sonic sensor to a distinguishable level, combining the signal with a predetermined signature signal, reducing signal noise, and determining whether the resulting signal represents one or more predetermined types of vehicle tire leaks for a predetermined time period.

134. A vehicle tire leak detection system for detecting a leak of a vehicle tire, comprising:

one or more sonic sensors adapted to sense the leak of a vehicle tire and transmit a signal representative of the sound of the leak of the vehicle tire; and

a base unit including

electronics adapted to receive the signal and process the signal to determine if the signal represents one or more predetermined types of vehicle leaks; and

a communication device coupled to the electronics and adapted to communicate to one or more entities that a vehicle tire leak has been detected.

135. The system of claim 134, wherein said electronics include a pre-amplifier adapted to amplify the signal from said at least one sensor to a distinguishable level, a mixer adapted to combine the signal with a predetermined signature signal, a low-pass filter and a precision rectifier adapted to reduce signal noise, and a time domain characterization mechanism adapted to determine whether the resulting signal represents one or more different types of vehicle tire leaks for a predetermined period of time.

136. The system of claim 134, wherein said time domain characterization mechanism includes a charge pump.

137. The system of claim 134, wherein said time domain characterization mechanism includes a quantitative characterization device, the quantitative characterization device includes a microprocessor adapted to determine whether the resulting signal represents one or more different predetermined types of vehicle tire leaks for a predetermined period of time.

138. The system of claim 134, wherein said communication device is adapted to communicate with a driver of a vehicle that the vehicle tire leak is from.

139. The system of claim 134, wherein said communication device is adapted to communicate with a vehicle dispatcher that a vehicle tire leak took place.

140. The system of claim 134, wherein said base unit is adapted to be powered by a battery, and said communication device is adapted to communicate to one or more entities that the battery is low and needs to be replaced.

141. The system of claim 134, wherein said one or more sensors are adapted to communicate wirelessly with said base unit.

142. The system of claim 134, wherein said one or more sensors are adapted to communicate with said base unit through wired means.

143. The system of claim 134, wherein said one or more sensors include one or more different types of sensors adapted to sense different types of vehicle tire leaks.

144. The system of claim 134, wherein said one or more sensors include one or more of the following types of sensors: a piezoelectric sensor, a dynamic sensor, an electret sensor, a carbon sensor, a bolometer sensor, an optical reflection sensor, a capacitive sensor, an inductive sound sensor, and an ultrasonic sensor.

145. The system of claim 134, wherein said electronics are adapted to filter said signal using a technique from the group consisting of duration and time coding of the sound, digital code quantitization, digitized algorithm analysis, and Fourier Transform analysis.

146. The system of claim 134, wherein said one or more sensors are integral with said base unit.

147. The system of claim 134, wherein said base unit includes an automatic location identification device adapted to determine the location of the vehicle.

148. The system of claim 134, wherein said communication device is adapted to communicate to one or more entities one or more of the following: a vehicle tire leak has been detected, the vehicle that the vehicle tire leak is from, the location of the vehicle that the vehicle tire leak is from, the type of vehicle tire leak, and the time of the vehicle tire leak.

149. A method of detecting an act, comprising:

detecting a characteristic sound made by an act using one or more sonic sensors;

initiating an alarm indicating that the act took place.

150. The method of claim 149, wherein the act includes crying of a baby.

151. The method of claim 149, wherein the act includes equipment use.

152. The method of claim 151, wherein detecting equipment use includes sonically detecting one or more different types of equipment use.

153. The method of claim 152, wherein detecting equipment use includes sonically detecting equipment use with a sensor selected from the group consisting of a piezoelectric sensor, a dynamic sensor, an electret sensor, a carbon sensor, a bolometer sensor, an optical reflection sensor, a capacitive sensor, an inductive sound sensor, and an ultrasonic sensor.

154. The method of claim 152, wherein detecting equipment use includes detecting a sound spectrum pattern of a characteristic sound made by use of equipment.

155. The method of claim 152, wherein detecting equipment use includes detecting the use of one or more of the following types of equipment: a computer, a cash register, a copy machine, and a fax machine.

156. The method of claim 152, wherein detecting equipment use includes filtering a signal from said one or more sensors using a technique from the group consisting of duration and time coding, digital code quantitization, digitized algorithm analysis, and Fourier Transform analysis.

157. The method of claim 152, wherein initiating an alarm includes communicating to one or more entities that equipment use has taken place.

158. The method of claim 152, wherein initiating an alarm includes communicating to one or more entities one or more of the following: equipment use has been detected, the type of equipment that the use has been detected from, the location of the equipment that the equipment use has been detected from, and the time of the equipment use.

159. The method of claim 152, wherein detecting equipment use includes detecting equipment use using one or more sensors and a base unit powered by a battery, the method further including communicating to one or more entities that the battery is low and needs to be replaced.

160. The method of claim 152, wherein said one or more sensors communicate wirelessly with a base unit, and detecting equipment use includes transmitting a signal representative of the sound made by the equipment use to the base unit for processing of the signal.

161. The method of claim 152, wherein detecting equipment use includes determining whether equipment use occurred using electronic spectral analysis.

162. The method of claim 152, wherein detecting equipment use includes amplifying a signal from said at least one sonic sensor to a distinguishable level, combining the signal with a predetermined signature signal, reducing signal noise, and determining whether the

resulting signal represents one or more predetermined types of equipment use for a predetermined time period.

163. An act detection system for detecting an act, comprising:

one or more sonic sensors adapted to sense a characteristic sound made by an act and transmit a signal representative of the characteristic sound made by the act; and

a base unit including

electronics adapted to receive the signal and process the signal to determine if the signal represents one or more predetermined types of acts; and

a communication device coupled to the electronics and adapted to communicate to one or more entities that an act has been detected.

164. The system of claim 163, wherein the act is crying of a baby.

165. The system of claim 163, wherein the act is equipment use.

166. The system of claim 165, wherein said electronics include a pre-amplifier adapted to amplify the signal from said at least one sensor to a distinguishable level, a mixer adapted to combine the signal with a predetermined signature signal, a low-pass filter and a precision rectifier adapted to reduce signal noise, and a time domain characterization mechanism adapted to determine whether the resulting signal represents one or more different types of equipment use for a predetermined period of time.

167. The system of claim 165, wherein said time domain characterization mechanism includes a charge pump.

168. The system of claim 165, wherein said time domain characterization mechanism includes a quantitative characterization device, the quantitative characterization device includes a microprocessor adapted to determine whether the resulting signal represents one

or more different predetermined types of equipment use for a predetermined period of time.

169. The system of claim 165, wherein said one or more sensors are adapted to communicate wirelessly with said base unit.

170. The system of claim 165, wherein said one or more sensors are adapted to communicate with said base unit through wired means.

171. The system of claim 165, wherein said one or more sensors include one or more different types of sensors adapted to sense different types of equipment use.

172. The system of claim 165, wherein said one or more sensors include one or more of the following types of sensors: a piezoelectric sensor, a dynamic sensor, an electret sensor, a carbon sensor, a bolometer sensor, an optical reflection sensor, a capacitive sensor, an inductive sound sensor, and an ultrasonic sensor.

173. The system of claim 165, wherein said electronics are adapted to filter said signal using a technique from the group consisting of duration and time coding of the sound, digital code quantitization, digitized algorithm analysis, and Fourier Transform analysis.

174. The system of claim 165, wherein said one or more sensors are integral with said base unit.

175. The system of claim 165, wherein said base unit includes an automatic location identification device adapted to determine the location of the equipment use.

176. The system of claim 165, wherein said communication device is adapted to communicate to one or more entities one or more of the following: an equipment use has

been detected, the time of the equipment use, the type of equipment use, and/or the location of the equipment use.

177. The system of claim 165, wherein said base unit is adapted to be powered by a battery, and said communication device is adapted to communicate to one or more entities that the battery is low and needs to be replaced.

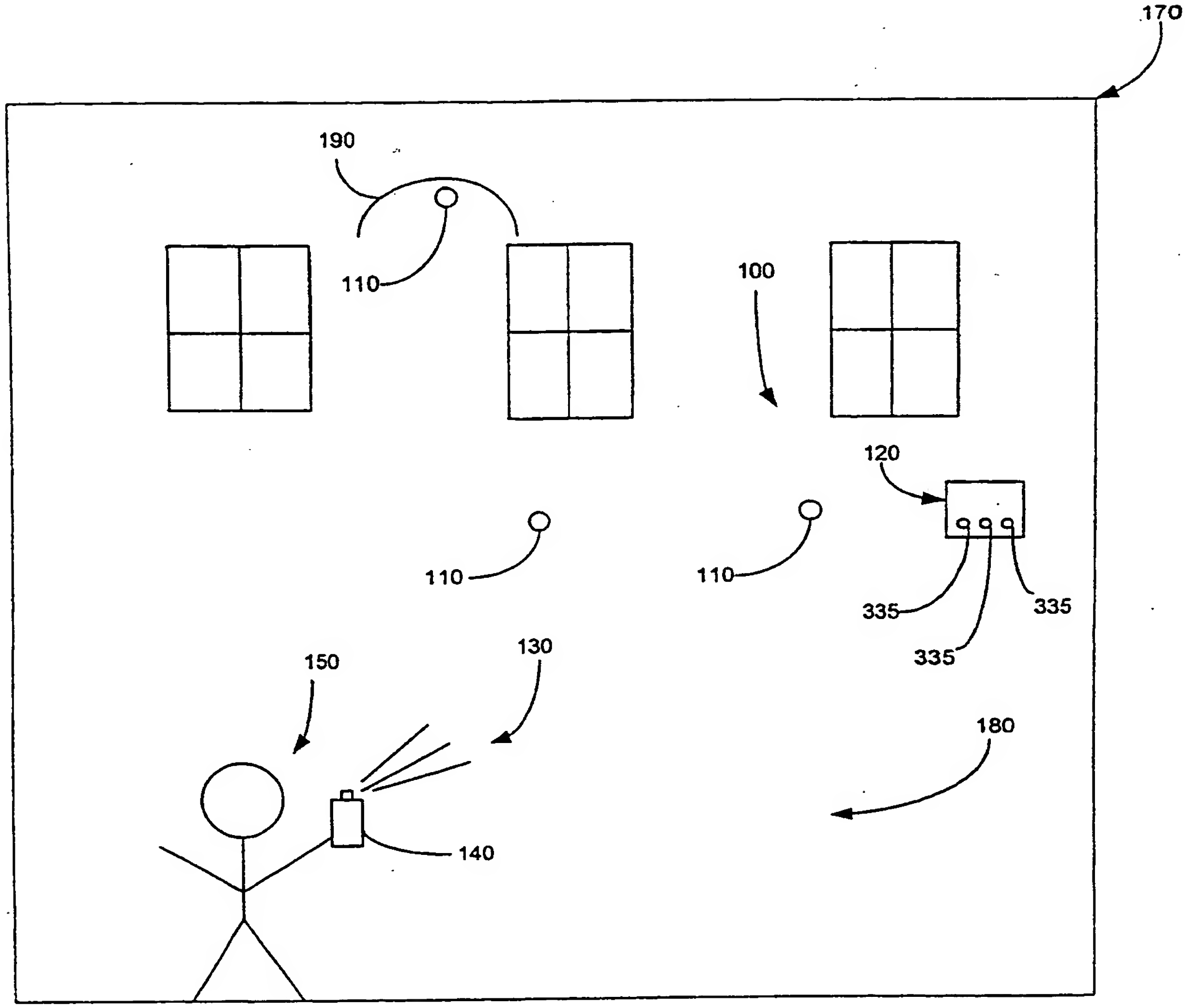


FIG. 1

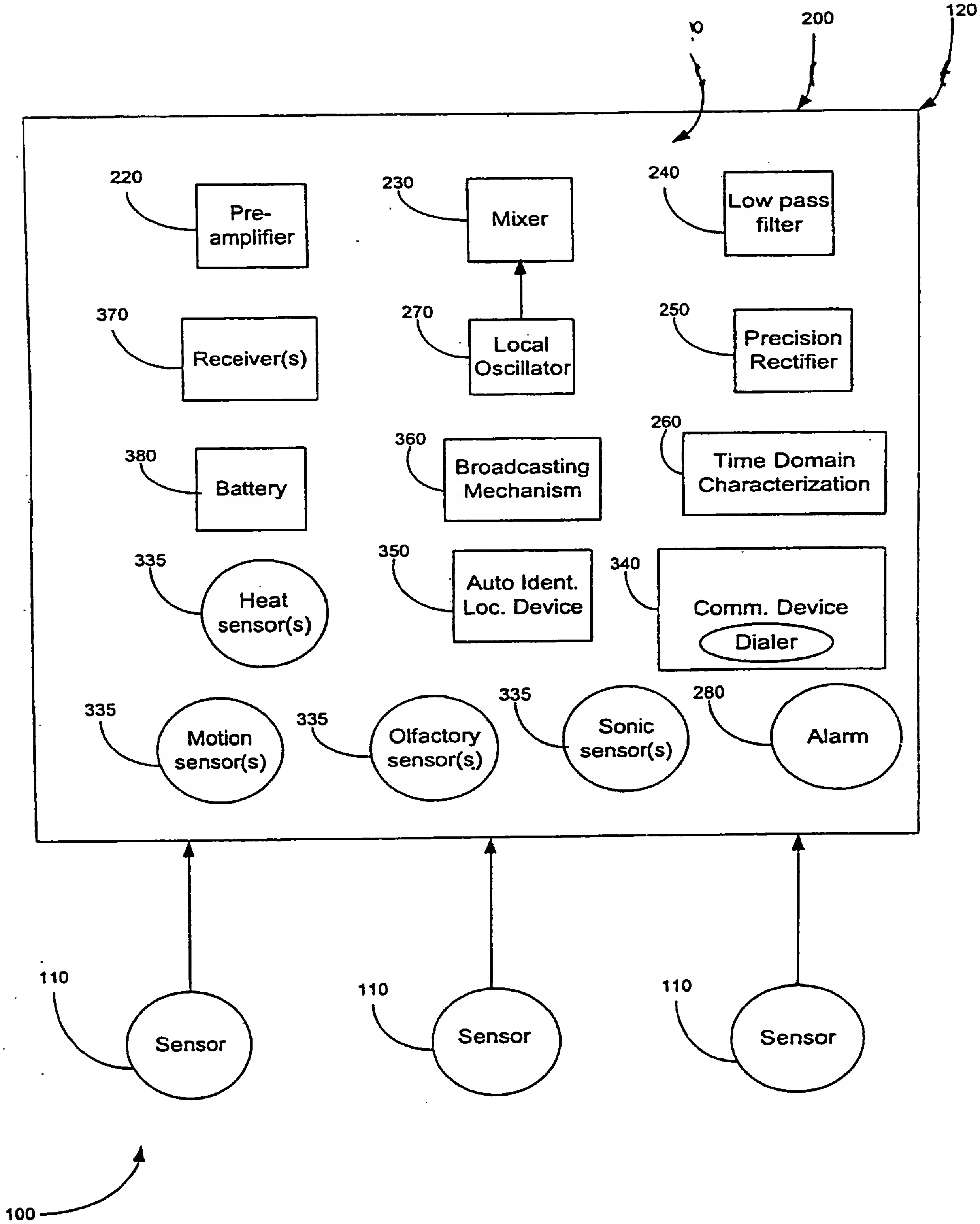
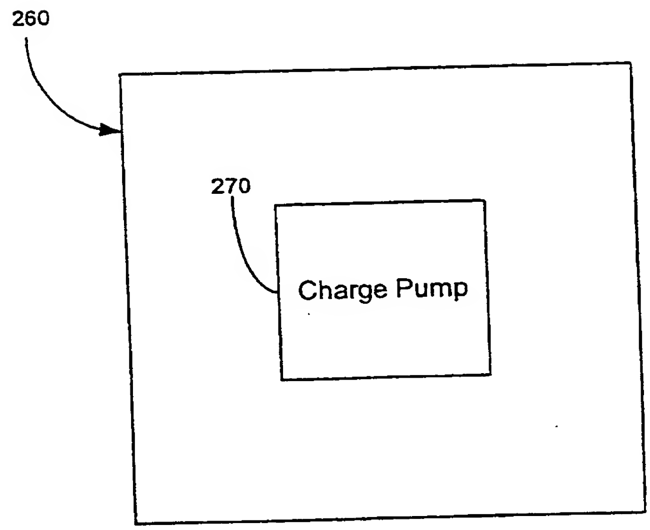

10
200
120
220
Pre-amplifier
230
Mixer
240
Low pass filter
370
Receiver(s)
270
Local Oscillator
250
Precision Rectifier
380
Battery
360
Broadcasting Mechanism
260
Time Domain Characterization
335
Heat sensor(s)
350
Auto Ident. Loc. Device
340
Comm. Device
Dialer
335
Motion sensor(s)
335
Olfactory sensor(s)
335
Sonic sensor(s)
280
Alarm
110
Sensor
110
Sensor
110
Sensor
100

FIG. 2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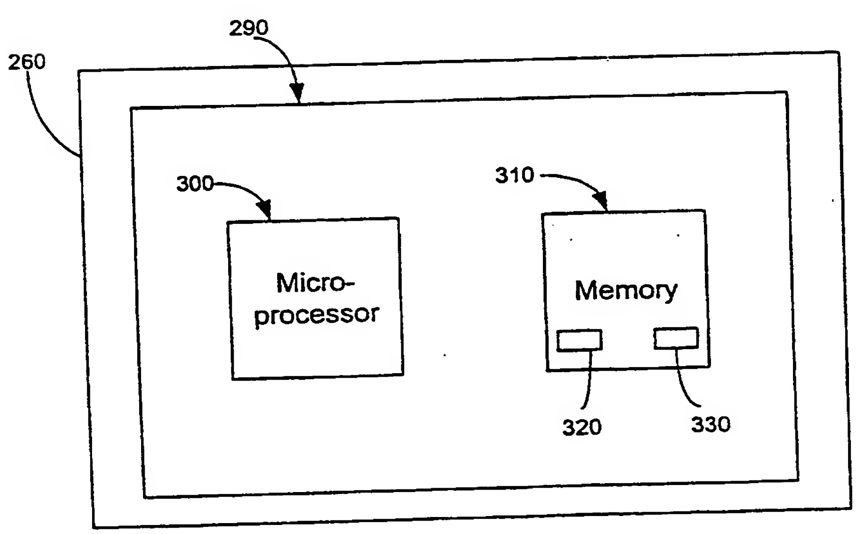
270
Charge Pump

FIG. 3A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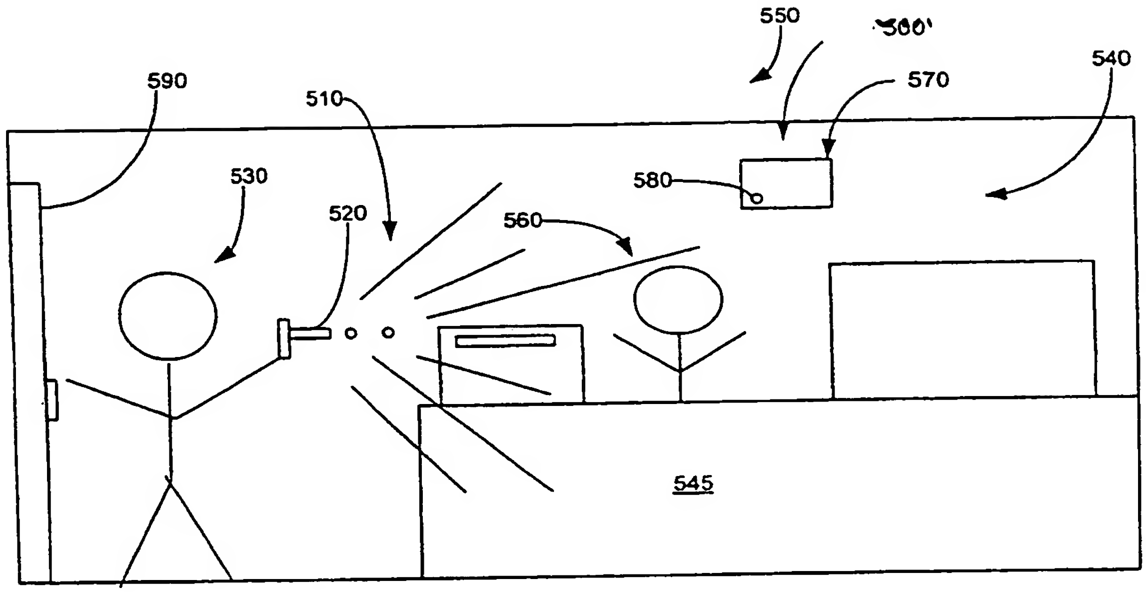
Micro-
processor
310
Memory
320
330

FIG. 3B


550
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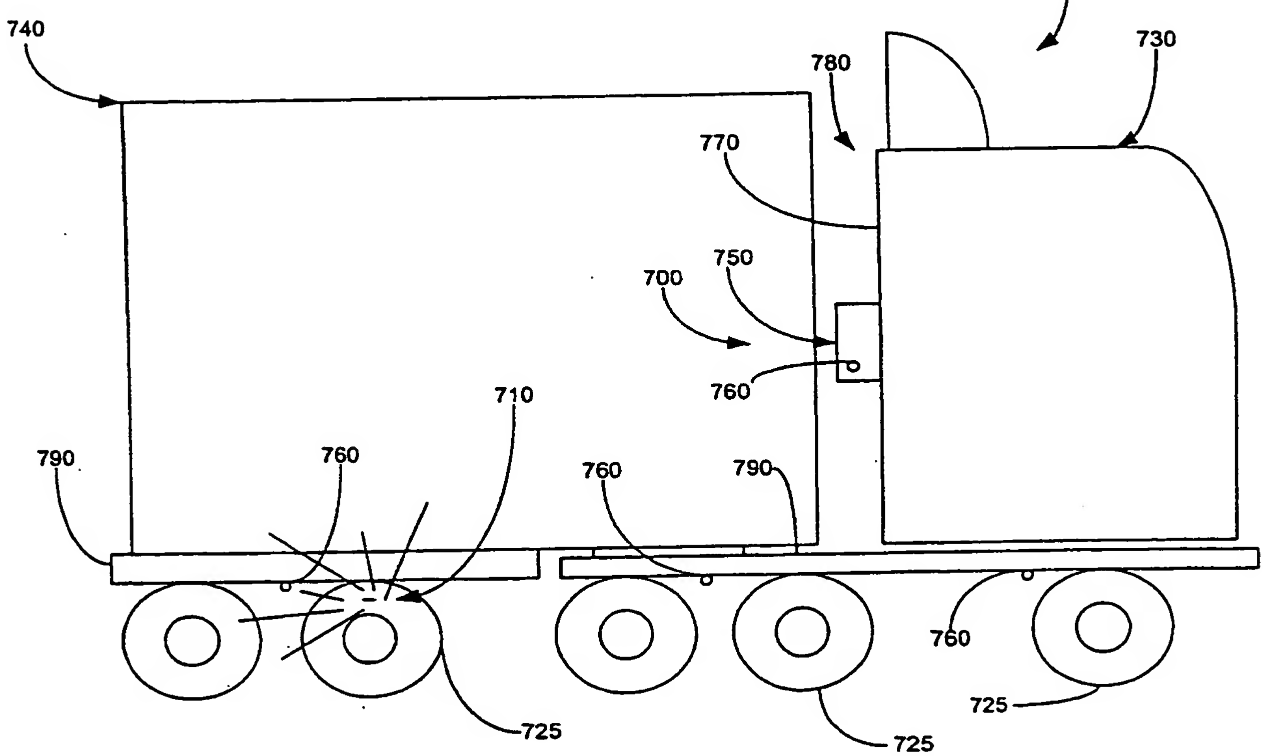
540
570
590
510
580
530
520
560
545

FIG. 4A


720
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770
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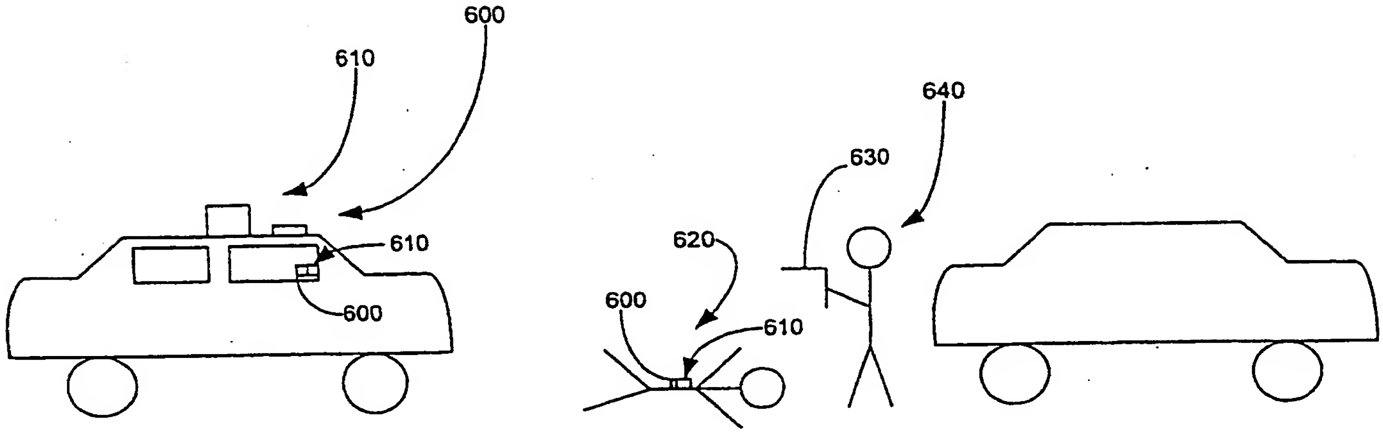
700
760
710
790
760
760
790
760
725
725
725

FIG. 5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610
640
630
610
620
600
600
610

FIG. 4B

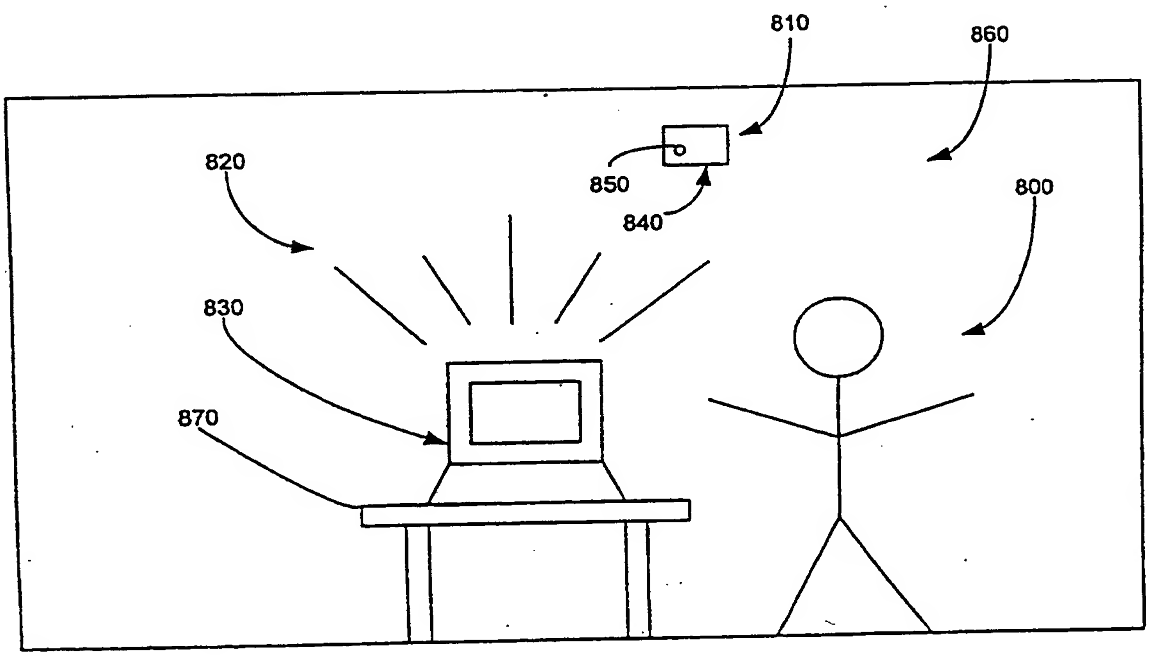
810
860
820
850
840
800
830
870

FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/15610

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :G08B 21/00
US CL :340/540
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : Please See Extra Sheet.

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EAST

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,528,220 A (WOODS) 18 JUNE 1996, ABSTRACT	1-72
Y	US 5,839,109 A (IWAMIDA) 17 NOVEMBER 1998, ABSTRACT	1-72
A	US 4,996,521 A (HOLLOW) 26 FEBRUARY 1991, ABSTRACT	1-72
A	US 5,855,297 A (TICHENOR ET AL.) 05 JANUARY 1999, ABSTRACT	1-72
A	US 5,675,318 A (HUNT, JR.) 07 OCTOBER 1997, ABSTRACT	1-72

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search 09 OCTOBER 2000	Date of mailing of the international search report 14 NOV 2000
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer NINA TONG Karen L. Ward Telephone No. (703) 305-4831

Form PCT/ISA/210 (second sheet) (July 1998)★

B. FIELDS SEARCHED
Minimum documentation searched
Classification System: U.S.

340/540,902,904,943,442,446,539,541,546,545.2,545.4,566,565,571,573.1,621,683,691.1,
692,691.2

BOX II. OBSERVATIONS WHERE UNITY OF INVENTION WAS LACKING
This ISA found multiple inventions as follows:

This application contains the following inventions or groups of inventions which are not so linked as to form a single inventive concept under PCT Rule 13.1. In order for all inventions to be searched, the appropriate additional search fees must be paid.

Group I, claim(s)1-72, drawn to GRAFFITI SOUND SENSING DEVICE.

Group II, claim(s) 73-119, drawn to FIREARM SHOT SOUND SENSING DEVICE.

Group III, claim(s) 120-148, drawn to TIRE DEFLATION SOUND SENSING DEVICE.

Group IV, claimS 149-177, drawn to AN ACT SOUND SENSING DEVICE.

The inventions listed as Groups I,II,III,IV do not relate to a single inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: EACH GROUP'S INVENTION IS AN INDIVIDUAL INVENTION AND DIFFERENT & INDEPENDENT FROM EACH OTHER AS SHOWN ABOVE.

4/7/254 • (Item 25 from file: 636)
DIALOG(R)File 636:Gale Group Newsletter DB(TM)

PO 2001 p.2

04036130 Supplier Number: 53379488 (THIS IS THE FULLTEXT)

ATM Prospectors Seek Data Mining Gold.

Bank Network News, pNA
Jan 13, 1998

XP002905983

TEXT:

Marketers know that you do not sell skateboards to senior citizens, nor do you pitch Grecian Formula to teenagers. But direct marketers struggle to reach their **target** audience amid a sea of consumers. In the banking world, the ability to **advertise** a financial product specifically to an individual while he or she is using an **ATM** is like the cruise missile of direct marketing. The ad finds its **target** and hits while consumers are engaged in an activity where they are thinking about finance. While the technology to do just that exists, online marketing through bank terminals is just a gleam in the eyes of many EFT executives. "To say we're planning to do that would be too concrete," says Thomas M. Tremain, first vice president of First Chicago NBD Bank. "Dreaming is more like it." But some banks already **target** market through **ATMs** . And more institutions will do so, industry executives say, thanks to tools like data warehouses and data marts - databases that store information for analysis - and data mining software that plucks relationships from that information. Currently, only 6% of banks use data mining to support the delivery of **targeted** messages through such self-service systems as **ATMs** , information kiosks and personal computers, says Mentis Corp., a Durham, N.C.-based research firm. Among those leading-edge institutions is Star Bank. The Cincinnati bank partnered with Dallas-based Fujitsu-ICL Systems Inc. for a data-mining pilot during November that flashes ads for a bill payment service on four **ATM** screens during the few seconds that cardholders wait for their transactions to be processed.

First, messages were displayed to anyone who used the **machines** . But during the test's second phase, messages appeared only to individuals who fit Star's profile of potentially interested **customers** , such as those with checking accounts. The **targeted** ads attracted 10% more requests for follow-up than did the ads that appeared to every **ATM** user, says Robert W. Tyler, Fujitsu-ICL's director of advanced technology. Star segmented that offer further between **customers** and employees. The **ATM** recognized the employees' cards and flashed a different **advertisement** , offering the bill payment service for free. The employees' response rate was 14% more than that of the bank **customers** . Star and Fujitsu implemented the system without having to tinker with the software from Applied Communications Inc., Omaha, Neb., which Star uses to drive its **ATMs** . "Our key requirement was that we implement this without involving the driving software," Tyler says. "That program is so complex its takes an army to make changes on it." Technical Requirements The partners took **customer** account data out of the bank's IBM legacy system and loaded it into a personal computer-based server. Information on a subset of Star's cardholders was combined with transaction data from teller computers, **ATMs** and other sources to build a data mart, which resides on the server. Queries from bank employees searching for marketing opportunities within the data mart are run by software on the server. Data marts are smaller repositories than data warehouses that store information from many departments or even the entire company. Marts take just months to build and cost tens to hundreds of thousands of dollars whereas data warehouses typically require three to five years to complete and can cost as much as $5 million. The notion that data warehouses are essential for segmenting **customers** is a myth, says Tyler. Rather than calling on every scrap of information, Star's campaign just needed **customer** account and balance data which fit easily in a data mart. This way, banks find prospects immediately rather than waiting years to build a warehouse. Fujitsu can build a data mart linked to **ATMs** , teller stations, call centers and other points of delivery in about seven months for a medium-sized bank for about $500,000, Tyler says. Once **customer** profiles and patterns are extracted from the data mart, the information is loaded into the **ATM** , which requires the power of a 486 or Pentium processor to run the application.

4/7/246 (Item 17 from file: 636) PO.2001 P=2
DIALOG(R)File 636:Gale Group Newsletter DB(TM)

04378657 Supplier Number: 55130984 (THIS IS THE FULLTEXT)
Drilling For Customer Data On ATMs Made Easier.
Bank Network News, pITEM99193004
June 9, 1999
XP002905981
TEXT:

Coming soon to a screen near you!

New, personalized ads and promotions-designed to accommodate your every financial need and desire. On local ATMs everywhere!

That could be the opening marketing salvo as two companies prepare to launch a new delivery system later this year that will enable banks to **target** ads to individual **ATM** customers, customizing the messages based on warehoused data on each consumer from remote data bases.

Canton, Ohio-based Diebold, Inc. has created a new product, known as iqCRM, that is capable of identifying ATM users and then immediately screen personalized ads to the customers as they wait to use the terminals. Newton Square, Pa.-based Naviant Technology Solutions, Diebold's partner in the venture, brings to the project expertise in warehousing and customer relationship marketing.

Officials from the two companies see the ATM as an untapped marketing channel for banks to reach their customers. Moreover, through the terminals' touch pads, the ATM allows for immediate consumer response to solicitations for further information or contact.

Banks have long recognized the power of individualized **ATM advertising** . But technical obstacles have prevented widespread use of data mining through **ATMs** . La Jolla, Calif.-based Fujitsu-ICL Systems Inc. **ATM** maker, for two years has offered its DataMart product used by Cincinnati, Ohio-based Star Banc on a handful of high-end **ATMs** . DataMart stores **customer** information on a terminal's computer memory for retrieval when a bank **customer** uses one of the participating terminals The **customer** information cannot be accessed by other terminals, whereas the Diebold-Naviant iqCRM product has **ATMs** communicating with a much larger, remote data base of **customer** information. Any **ATM** connected to the data base can tailor the **customer** information.

Alan D. Falconer, director of global systems sales for Diebold, hopes to see the system implemented in four to six months. No bank is currently piloting the product, he says.

Channeling

Kathleen Khirallah, a senior research analyst with Tower Group, a Needham, Mass., research and consulting firm in strategic application of information technology for financial services, believes the Diebold/Naviant initiative fills a genuine gap in marketing communications.

"They're taking a channel, the ATM, and they're using it as a communications link," she explains. "And the communications are specific and appropriate to the individual customer, which is a tremendous step forward from what the ATMs have done."

Naviant Vice President C. Win Billingsley, who first approached Diebold with the concept of **targeted ATM advertising** a year ago, says the timing is finally right for such an idea.

"Until banks had sophisticated customer relations marketing, this was impossible," Billingsley says. "And until ATMs themselves became technologically powerful, this was impossible. Also, banks are trying every way to get a higher rate of return on their ATM investments. They're trying to turn the ATMs from a cost factor to a profit center. They're trying to sell everything under the sun on ATMs except bank products themselves. So you have all three of these forces coming together."

The issue of using stored data on customers for any type of marketing is always a sensitive one for privacy concerns, and Diebold and Naviant have discussed the potential consequences.

"It's obviously a conversation we're having,' says Falconer. "But we feel the consuming public will be much more appreciative when they are offered products that mean something to them, rather than when they're just being blanketed with advertising that just does not apply to them."

Thus, a bank ad for home equity loans might appear only on the ATM